

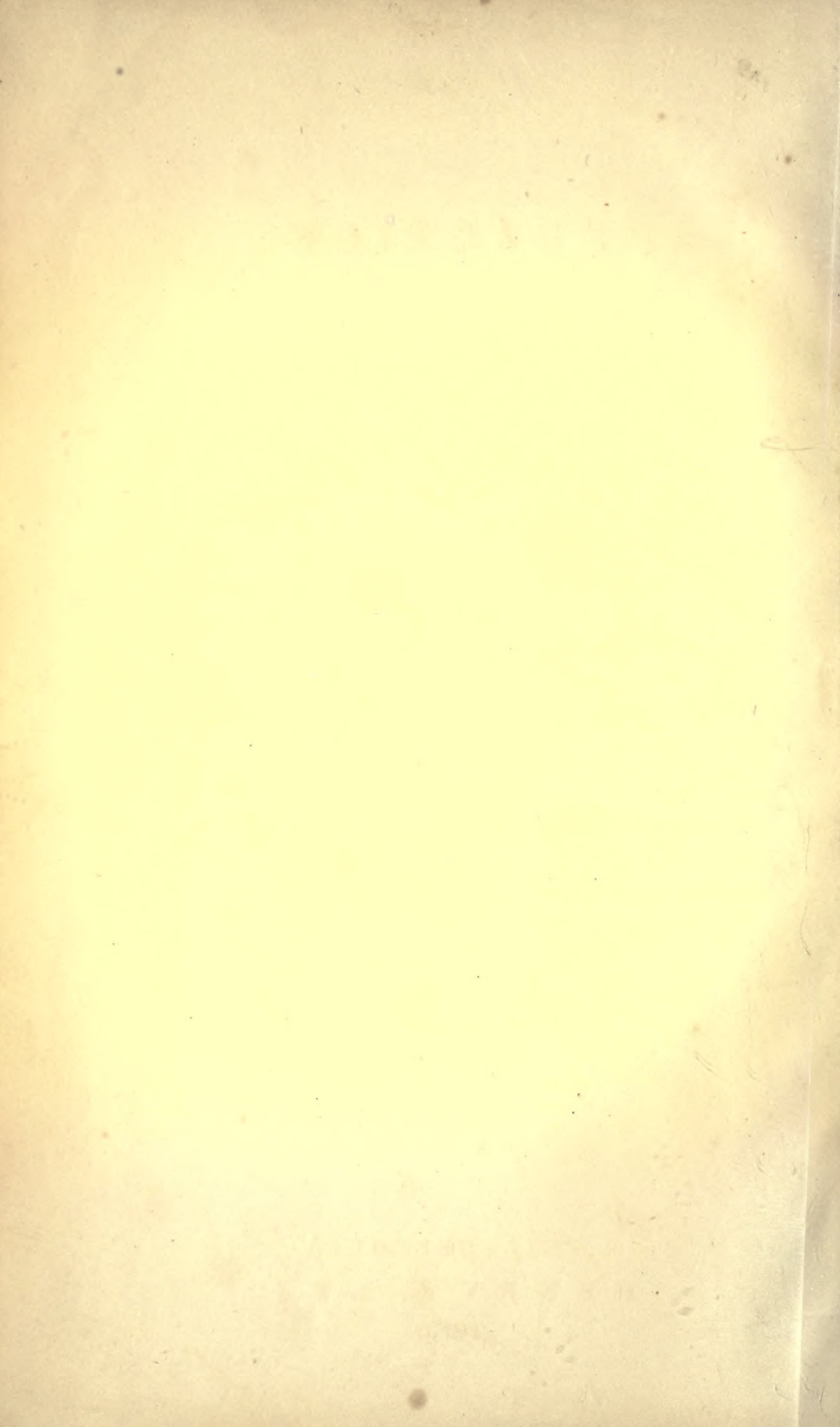


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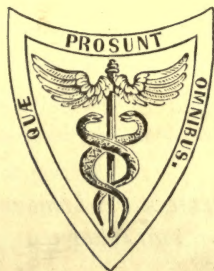


MS.
B.

THE
PRACTICE
OF
SURGERY.

BY
THOMAS BRYANT, F.R.C.S.,
SURGEON TO GUY'S HOSPITAL.

WITH FIVE HUNDRED AND SEVEN ILLUSTRATIONS.



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PREFACE.

WHEN the eminent publishers of this book invited me to write a work on the Practice of Surgery, under the impression that there was room for a new text-book on the subject, and within certain limits liberally left its execution entirely in my hands, with full permission to illustrate it as I liked, I gave the offer my serious consideration, well weighing its difficulties and its responsibilities.

But when the Treasurer of the Hospital, to which I have the honor to belong, generously and kindly placed at my disposal the rich stores of information gathered within the walls of Guy's, in the shape of preparations, models, and drawings, I accepted the offer, and now present the result of my labors to the kind consideration of my professional brethren.

That my task has not been completed up to the standard I had conceived I feel deeply conscious, although no pains or thought have been spared in its performance; but if the manner of the execution of the work be faulty, the matter I believe to be sound, for the practice I have inculcated has, in most points, been tested by experience.

Throughout its composition I have tried to do full justice to the works of others, and by quotations have made them speak for me when I could; if I have failed to do this in all cases, it has been from want of space, for all through the work the object has been to give only what was essential, and to condense as much as possible.

If I have drawn largely from the Guy's Museum to illustrate these pages, it has been because I found all I wanted within its walls, and possibly my readers will pardon me for having used my own material in preference to others', if they find it good.

Should some of the opinions that have been expressed differ from those usually received, and the practice based upon them seem unusual, I must ask my readers to test them before they are condemned, for they have only been introduced after serious consideration.

I have not consciously omitted any subject which comes under the notice of the general surgeon, although the rightly recognized specialties of eye, ear, and dental surgery have been excluded. To have given them in outline would have been to mislead, and to have done more would necessarily have added much to the size of the volume.

In the execution of this work I have received kind encouragement and aid from some to whom I now tender my thanks. To Mr. Thomas Turner, the Treasurer of Guy's, I give it for the liberal and friendly way in which he placed at my disposal the riches of the institution over which he so ably presides. To my colleague Dr. Moxon for the valuable chapter with its drawings upon the microscopical anatomy of tumors, &c. To Mr. Howse for a remarkable diagram illustrating the subject of repair, and to Drs. Phillips and Goodhart for their kind aid in passing these pages through the press.

To my lamented colleague, Mr. Poland, I have been much indebted for advice and assistance during the whole progress of the work. With a singularly generous nature he took as lively an interest in its progress as that of a brother. To his full knowledge and clear judgment I have been on this as on many past occasions a debtor, and the remembrance of the pleasant criticisms with which he favored many of these pages, as they were written and submitted to him, will form not the least agreeable recollections of its composition.

To Mr. Wesley, the artist, I offer my sincere thanks, as much for the labor he has bestowed upon the work as for the appreciative skill with which he has executed the drawings found within its pages; for I may add that out of the five hundred engravings four hundred are original—taken either from preparations or drawings in the Guy's Hospital Museum, or copied from nature. To those taken from other works the names of the authors from which they have been borrowed have been appended.

It is to be remembered that this work is a manual of the Practice of Surgery; it deals only with essentials and principles; it is not intended to compete with such valuable works as Paget's "Surgical Pathology" and Holmes's "System." To these the student may refer when more detail is wanted.

THOMAS BRYANT.

2 FINSBURY SQUARE,
September, 1872.

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THE PRACTICE OF SURGERY.

INTRODUCTORY CHAPTER.

WHAT to observe in the practice of surgery is undoubtedly the most difficult duty a student has to learn, and how to observe is his first problem. The uneducated eye may see a thing that is placed before it, but the educated eye alone can perceive its points, and read the meaning of the phenomena it presents. The art of surgery, to be successful, must be based upon the science, and the science is, without doubt, based on observation. At the bedside of a patient the phenomena of disease are to be studied, its symptoms recognized and duly weighed. Here, nature is to be fully interrogated, and all sources of fallacy are to be eliminated. In the closet the facts obtained by observation are to be arranged and digested, for clinical phenomena cannot be too closely considered, nor can their value be over-estimated.

It is hardly necessary to add that this habit of observation is to be carried out still further, and that the results of disease after death are of no less value than are its phenomena during life, the facts deduced from the dead, associated with those recognized in the living, together building up the science of our art. Both series ought always to go hand-in-hand in the study of our profession, and must ever be the basis of its successful practice.

It will be my aim in the following work to demonstrate the truth of these assertions. To clinical phenomena will be given the leading place, and, where possible, pathological phenomena will be linked with them. When practice can be based on principle, this will be enforced; whether founded on experience or empiricism, must be stated. To connect symptoms of disease during life with pathological phenomena will always, however, be my aim; and to establish practice on principles will be my object.

By way of introduction I propose briefly to consider by what method a correct opinion is to be obtained in any given instance; how sources of fallacy are to be best eliminated, and a correct diagnosis is to be established; for it cannot be too forcibly impressed upon our minds that no treatment can be successful unless based on a clear understanding of the wants of the individual case we have before us, and that these can never be duly appreciated where a correct diagnosis of the nature of the case has not been made. All sources of fallacy should consequently be eliminated in every instance, probabilities carefully weighed, and evidence estimated. The judicial mind of the surgeon overriding all prejudices and preconceived

ideas, suppressing the advocacy of all unsupported theories and hypotheses, accepting clinical facts as they are observed, and pathological data when they can be made out, should come to a conclusion cautiously and clearly, after a due balancing of the facts of the case, based on the possibilities and probabilities of its nature.

To form a diagnosis of a case mainly on probabilities as indicated by its symptoms, may be a ready, but it will ever be a rash, proceeding. To form it on the possibilities, will always be a safe, although, perhaps, a less expeditious practice. A surgeon who acts upon the first method must, at times, fall into grave errors, although his diagnosis will often appear brilliant and successful; but he who habitually frames an opinion after taking into consideration every possibility of the case he has before him, and by a process of elimination comes to a conclusion, must surely, on the whole, be more certain in his ends, and he will be a safer and sounder practitioner.

From this great principle of investigation, which is alike applicable to all cases of injury as well as of disease, the following conclusion may consequently safely be deduced:

That in the diagnosis of a case every possibility of its nature should be run over and entertained, a conclusion being arrived at by a process of elimination; each possibility being considered separately and weighed, the most probable should be finally accepted; a diagnosis framed on probabilities alone being most hazardous.

For example, a tumor at the femoral ring may *possibly* be an abscess, a varix, an aneurism, a cyst, a hernia, an enlarged gland, or a growth. Its probable nature will be best arrived at by eliminating each of these possibilities *seriatim*, after considering them in connection with the symptoms that are present: the most probable diagnosis being finally accepted on evidence both negative and positive.

With the above great principle of practice to guide us in the investigation of a case, I will now proceed to consider how any case of injury or disease is to be thus interrogated; confining my observations to classes of disease. I do not propose, however, to point out to the student the exact mode in which it is well to examine a case or to report it—for the latter is only a written examination—beyond reminding him that at pages 22–24 an outline will be seen, which will probably be found of use in aiding him in his task. I drew it out many years ago when surgical registrar at Guy's, where it has been generally followed ever since.

When a surgeon is called to a patient, his questions naturally apply first of all to the seat of disease or injury. Is it in the head, chest, abdomen, or extremities? Next, as to its duration. When was the injury received? When was the disease discovered? If a case of injury, his inquiries would tend to elicit the exact mode of its production, the force employed, and the character of instrument with which it was produced. All these points are of essential importance, and cannot be too closely inquired into. In head injuries they often give the key to the solution of many questions. By these means the exact seat of injury will probably be indicated, and the surgeon will be led to make a close examination of the injured part; but he should never fail to assure himself that all other parts of the body are sound and in working order, that no other part is involved in disease, or is the subject of injury; for it would be a forlorn hope to amputate for a crushed limb when associated with a ruptured liver, or to reduce a dislocated joint when combined with some fatal internal lesion.

Let us now briefly consider the mode of investigating a case of injury or disease of the head or nervous system. The most important point a surgeon has to determine, in all cases of injury or disease of the head has

reference to the exact seat of the affection. Is it confined to the soft parts covering the bone, or are the contents of the skull in any way involved? for if the former condition exists, the disease is comparatively of small importance; if the latter, its gravity cannot be too highly estimated. Scalp wounds, however severe, have, as a rule, a successful ending; whilst brain injuries, however trivial, should always be regarded with apprehension, for they may lead to the most serious complications.

When no signs of brain disturbance have been observed after an injury the diagnosis is not difficult, for without symptoms, local or general, a surgeon may be excused from entertaining the idea of brain complication. But when indications of brain disturbance exist, the difficulty arises, for it cannot be too firmly impressed on the student's mind that the same symptoms may be produced by concussion as by compression of the brain; and that in compression, depressed bone pressing on the brain, and blood effused upon its surface, or within its structure give rise to precisely the same phenomena. An apoplexy, the result of a ruptured vessel, and hemorrhage into the brain from an injury, are almost identical as to their manifestations, and what we call functional disturbance of the brain may give rise to every symptom of organic mischief; and yet whilst the student of surgery must remember that the clinical symptoms to which these different conditions give rise may be apparently identical, he must know that the clinical *history* of each of these cases will, on inquiry, be found widely to differ, and the collateral evidence of each will furnish the right clue to a successful diagnosis.

Where no clinical history can be obtained the difficulties of diagnosis are, indeed, great: for example, when the surgeon is called to see a man who has been picked up in the street, and is insensible; who is, in fact, in an apoplectic condition, and has, at the same time, some external evidence of injury to his skull; he may, perhaps, also smell of spirits, and thus another element of difficulty has been added. The questions that arise in the surgeon's mind under these circumstances are very conflicting. Did this man have a fit and then fall? or are the symptoms due to a brain injury, the result of an accident? Was he knocked down and injured, or did he fall? Are the symptoms caused by drunkenness, or how far are they complicated with it? Are they the result of blood-poisoning from kidney disease or poisoning by opium?

To unravel all these points, great care and discrimination are required. Too much cannot be bestowed upon the task, for to treat an apoplectic seizure, or severe brain injury from external violence, for drunkenness, is a grave error; and it would be well if I could add that it was never committed. To mistake drunkenness for apoplexy or severe head injury is, perhaps, a less grave fault, although it is, without doubt, a serious one. As a point of practice, however, it is probably a wise rule to regard all these suspicious cases from the more serious point of view, to watch and wait for symptoms to indicate the practice that should be pursued.

What I wish now to impress upon the reader is the necessity of bearing in mind that all these different conditions to which I have alluded present to the surgeon many features in common, and that a correct diagnosis can only be arrived at by a process of elimination. The possibilities of the case have been suggested. The probabilities can only come out of a rigid inquiry, even into the minutest circumstance that can be obtained.

In cases of local paralysis the difficulties of diagnosis are very great. Is the cause a *central* one—that is, is it in the brain or cord? or is it a *peripheral* one—at the termination of the nerves? or is it *local*?

If one of the two former causes, the history of the case will probably

form a true guide to the surgeon; and if the latter cause, some local injury to the nerves supplying the part, some tumor or aneurism pressing upon the nerves, will probably be found; or perchance it may be a case of lead palsy or infantile paralysis. But in these cases a true diagnosis will only be made by eliminating from our consideration the many possible causes and taking the most probable.

Again, *Let it be an invariable rule of practice in every case of injury or disease, to compare the sound side of the body with the affected one.* In the diagnosis of a dislocation or fracture, the information gained by the comparison is always of great value, and furnishes often to the experienced eye a true suggestion as to the nature of the accident. In joint disease, also, the practice is of equal importance; any effusion into a joint or enlargement of the bones being, as a rule, readily detected on making the comparison.

The nature of the disease or injury being thus suggested to the mind through the eye, the suggestion remains to be confirmed or corrected by a careful manual examination, by the other clinical symptoms, and by the history of the case; the facts elicited by the sight, by the hand, and by the ear, being made separately available, and the conclusion drawn after a careful balancing of the probabilities and possibilities of the case. The diagnosis will be well established when all these different modes of investigation lead to one conclusion. In surgery as in medicine the student must educate the eye to see and the hand to feel. The task is no simple one; it is, indeed, the most difficult a student has to learn, and he cannot begin it too early in his professional career. Reading will not help him, nor thought aid him; personal experience alone at the bedside will supply the want.

To recognize the existence of a wound, or the deformity of a broken bone, may not be difficult; but to read aright the endless phenomena which a wound presents, and to make out the character or tendency of the fracture, require much experience.

To see that a swelling exists in a part is open to the uneducated eye; but to recognize the various aspects that different tumors assume, to make out their form, position, and attachments, to estimate their consistence, to recognize the fluctuation of fluid, whether superficial or deep, and to detect pulsation, require considerable tactile power and much education. What education is also demanded to read the phenomena presented in diseases of the eye or the skin!

"No study of the written observation of others could enable any man to appreciate those endless varieties of the pulse which entirely baffle description, or to distinguish between the warmth of the skin, excited by various accidental causes, and the pungent heat accompanying the first stage of pneumonia, or acquaint him with the shrunk and shrivelled features derived from the long-continued disease of the abdominal viscera—the white and bloated countenance often attendant on changes in the functions or structure of the kidney—the squalid and mottled complexion of the cachexia dependent upon the united effects of mercury and syphilis—the pallid face of hemorrhage—the waxen hue of amenorrhœa—the dingy whiteness of malignant disease—the vacant lassitude of fever—the purple cheek of pneumonia—the bright flush of phthisis—the contracted features and corrugated brow of tetanus; all which shades of countenance, with many more that might be enumerated, are distinctly recognized by the experienced eye." (Dr. Bright, "Guy's Hosp. Rep.," 1836.)

The subject of *Diathesis* claims the attention of the surgeon, for its bearing on practical surgery is undoubted. In the *strumous*, *scrofulous*, and *tuberculous diatheses*, all of which appear to be closely allied, there is, no doubt, a tendency to glandular enlargement, the formation of caseous de-

posits and a low kind of inflammatory action, whether in the bones, joints, skin, or lungs; but beyond these clinical facts we know nothing. Disease in subjects who have these diatheses is precisely identical in its essential nature with the same disease as found in others who have them not. It may be modified in its course by the diathesis, but it is the same disease. These names have, likewise, no special signification when applied to local disease.

It is important for the surgeon to bear this fact in mind, for there can be little doubt that the expressions, strumous disease and scrofulous disease, have had an injurious influence on the practice of surgery. They have too often led the surgeon (and misled the public) to regard a local affection in a strumous or scrofulous subject as incurable, as depending on some general and not a local cause. In disease of the joints this evil has been much felt, and should be corrected.

The modern investigations of Drs. Sanderson and Fox in our own country, and Dr. Waldenburg¹ abroad, however, tend to show that the *scrofulous* diathesis in which there is a tendency to inflammation of a low type, gives rise, under some circumstances, to *tuberculosis*, and that local inflammatory affections of a chronic nature are specially prone to be followed by tuberculous disease. The gray granulations or tubercles are apparently derived from some pre-existing inflammation; from the absorption into the blood of the *caseous* or *cheesy* deposits which are supposed to be the residue of an antecedent inflammatory action—whether in the bones, joints, glands, or lungs—and their subsequent dissemination as miliary tubercle. Niemeyer, indeed, maintains that “the formation of tubercle never takes place unless preceded by pneumonia, terminating in caseous infiltration of the pulmonary tissue.” To the surgeon this aspect of matters is of immense importance, for it is clearly his duty, under such circumstances, to hasten the recovery of local suppurative disease as much as possible, and where this cannot be carried out, to remove it. For let it be once shown that local disease has a direct influence in producing constitutional dyscrasia—call it by what name we will—and the necessity of dealing actively with chronic local affections becomes a duty. It must be admitted that a local disease in a strumous subject may be as amenable to treatment as it is in a more healthy one. The treatment of the case may indeed require some modification from the fact of its occurring in such a subject, but the principles of practice in both the strumous and the non-strumous are the same, although we know that in the former all diseased action is of a low type, and that there is always a greater tendency to degenerative changes than we find in other subjects.

The *hemorrhagic* diathesis, also, is a subject of peculiar interest to the surgeon. That it is hereditary there can be no doubt, for it is very rare to meet with an example without being able to trace some antecedent family history of it. In some instances it affects several members of a family. It is shown by a peculiar tendency to bleed on the slightest provocation, and the difficulty there is in arresting hemorrhage when it has taken place. The surgeon should always have before him the possibility of his patient being a subject of this diathesis; for although it would not prevent the performance of any operation that is essential to save life, it would materially affect the question of operating for any reason of expediency, and tend to modify the practice.

One word also respecting *cachexias*.

Do they exist? Is there any definite aspect associated with any definite disease? Is there a cancerous cachexia? I have little hesitation in stating

¹ “Die Tuberculose und Scrofulose,” von Dr. L. Waldenburg. Berlin, 1869.

my belief that in practice no such thing can be established, and that a large number of patients suffering from cancer are as healthy-looking as any other class, indeed often healthier. There is no doubt that a patient suffering from cancer which, by its discharges or development, is interfering with the important functions of life, and undermining the patient's powers, has an anxious, drawn, bloodless, and waxy look; but so has the subject of any organic disease which interferes with the functions of digestion and assimilation, and particularly so the subject of rectal disease. The patient exhausted by suppuration, by spinal, bone, or joint mischief, the man or woman who from drink, syphilis, or mercury, separately or combined, is gradually being brought down to death's door, all these have a cachexia more or less peculiar according to the organ involved in the disease, and the special character of the patient; but it is merely the cachexia of looking ill. Clinically I read the meaning of a cachexia as a looking ill, perhaps very ill, but it has no other definite signification—looking ill from cancer, looking ill from abdominal, rectal, suppurative, or syphilitic disease.

POINTS FOR OBSERVATION IN SURGICAL CASES.

- | Disease or Injury. | Date when seen. | Result. |
|--|-----------------|---------|
| NAME, age, occupation, residence, general health, habits, and aspect. In some cases hereditary history. | | |
| PREVIOUS DISEASES OR INJURIES, with their dates. Treatment. | | |
| HISTORY OF PRESENT DISEASE OR INJURY.—Its assigned cause, or method of production. | | |
| ORDER OF SUCCESSION OF SYMPTOMS, with their former treatment, and date of any marked change in either symptoms or treatment. | | |
| PRESENT CONDITION AND APPEARANCES.—Passing in review, and noting when irregular the condition of intellect, senses, and nervous system. Organs of respiration and circulation. Pulse, frequency, force, volume, compressibility, distinctness, and rhythm. Digestive organs—tongue, appetite, bowels. Urino-genital organs—urine, catamenia. Integuments—eruptions, moist or dry, above or below natural heat. Locomotive organs—bones, joints, and muscles, whether paralyzed or in undue action. | | |
| PROGRESS OF THE CASE.—Note carefully any change in the old, or the appearance of new symptoms, with the date of change, and treatment, by medicine, diet, &c., &c. Carefully fill in the result, and date of departure; if unfavorable, the condition on post-mortem examination. | | |
| NOTE.—As the value of a Report depends upon its conciseness, together with the accuracy and number of recorded observations, it is unnecessary to write one unless an appreciable change in the symptoms exists. | | |

SPECIAL POINTS FOR OBSERVATION.

HERNIA.—Variety and character; its position, period of existence, assigned cause, and form; whether previously irreducible, and if a truss had been worn.

When **STRANGULATED**, give the symptoms, *general and local*, dating from the exact period of strangulation, the first appearance of sickness, character of vomit.

PREVIOUS AND PRESENT TREATMENT.—If by *taxis*, state whether forcible, and how long applied, with or without chloroform; when by *operation*, if sac was opened or not; if opened, *why*? its contents and their appearances. On reduction, note the time from the first symptoms of strangulation; success, immediate and final.

WOUNDS.—Variety, position, extent, and depth; how and with what produced; *when on scalp*, if exposing bone. Complications—hemorrhage, &c. Treatment and result—whether united by adhesion or granulation.

TETANUS.—Idiopathic or traumatic, partial or general; time of appearance after injury; position and condition of wound. Death—whether from spasm or exhaustion.

DISLOCATIONS.—Form and position; simple or compound; how and when produced; previous treatment.

SYMPTOMS, general appearance and position of the limb; mobility, pain, amount of injury to soft parts. Treatment—time after injury; by manipulation or extension; mode of application of extension; its direction, duration, and additional means, under chloroform. Result, immediate and final.

FRACTURES.—Simple or compound; how and when produced; position and direction of the line of fracture; its tendency; amount of injury to vessels and soft parts; in *compound*, note position and extent of wound; if produced by the primary force or broken bone; what vessels, nerves, or joints are involved. Constitutional symptoms.

TREATMENT.—Sand-bags, starch-bandage, splints; form of splint applied; date of application. Note the date of any change of local or general treatment.

FRACTURED SKULL.—Position, kind of injury, and direction of the force; if attended by hemorrhage, its amount, and whether from nose, mouth, ear, or external wound. Give evidence, if any, of brain mischief.

IN SUSPECTED FRACTURED BASE.—Paralysis of facial nerve; flow of blood or serum from ear, with the time of its first appearance after the injury; impaired vision, condition of hearing, and hemorrhage; if *subconjunctival*. If complicated with internal injury, as *concussion*, *compression*, &c.; carefully report symptoms in their order of succession, and whether immediately following the injury or not; the duration and amount of unconsciousness, insensibility; paralysis, its position, motion, sensation, or both; condition of sphincters; state of pupils; character and number of pulse, respiration; condition of skin. Treatment, &c.

DISEASED BONE.—Part affected; duration; cause, as external injury, syphilis, mercury; extent, superficial or deep, partial or general; previous treatment, especially as regards operations.

PRESENT SYMPTOMS AND APPEARANCES.—Condition of dead bone or *sequestrum*, fixed or loose; number and position of openings, or *external cloacæ*, with the date of their first appearance.

TREATMENT.—If by operation, its immediate success.

DISEASES OF JOINTS.—Part affected; date of first discovery; assigned cause, as injury. Note the early symptoms, in the order of their appearance, and date of any fresh symptom or marked change; if pain or uneasiness preceded swelling, or was coeval with it; if former, how long? Rapidity of progress; previous treatment, and its effects.

PRESENT APPEARANCES.—Position of joint; if flexed, the angle of flexure; size and shape.

CHARACTER OF SWELLING.—Uniform or bulging; manipular indications, hard, soft, elastic, or fluctuating; mobility, amount; if attended with grating, &c.; in the knee joint, note if the patella be free or not; if free, the sensation felt on moving it; condition of skin; if fistulous openings exist, their position, number, and character of their discharge, deep or superficial; note the date of their first appearance, and if natural or artificial. Pain, acute or gnawing; its position, general or local; if aggravated by motion, or interarticular pressure; if increased at night. Sleep, if disturbed by crying or starting of the limb; sympathetic pain, and its position; condition of muscles of limb; constitutional symptoms. Treatment.

STRICTURE.—Organic or traumatic; duration and assigned cause, especially as regards gonorrhœa; use of injections, or accident; if previously treated by catheter; complications, as abscess, fistula, with their position and date of appearance.

RETENTION.—Mention period of retention; preceding symptoms, and cause, as stricture, calculus, paralysis, abscess, prostatic disease, &c. Constitutional and local symptoms; previous and present treatment; puncture per rectum, note the date of removal of the caula, and arrest of the flow of urine through the wound.

EXTRAVASATION.—Cause, over-distension or accident; duration of retention before urethra gave way, and period that elapsed before being seen. Describe the appearances and extent of parts infiltrated; constitutional symptoms and treatment.

VENEREAL DISEASE.—Chancre, duration, position; glandular, urethral, coronal, or frænal—external, internal, or fringing preputial; character, indurated, non-indurated, aphthous, raised, excavated, irritable, phagedenic, or sloughing; tubercle; condition of inguinal glands, indurated or inflamed. *Previous treatment*, particularly as regards mercury.

COMPLICATIONS.—Note the date of appearance, and situation of each or any of the complications; the order and time of their occurrence after the primary sore. Present appearance and treatment of each.

GONORRHEA.—Date of contraction; former treatment, especially as regards injections, copaiba, &c. Complications, and their duration; in epididymitis, if following suppressed discharge, use of injections, copaiba, or violent exercise.

STONE IN BLADDER.—When discovered; date of earliest symptoms; if preceded by the passage of sand; amount of irritability of bladder; character of urine; constitutional and local symptoms. Treatment, lithotriety or lithotomy; in latter, note any peculiarity—date of arrest of the flow of urine through the wound.

TUMORS.—Date of its discovery and size; rapidity of growth; general and local symptoms, in their order of appearance. General health, prior to discovery and since; hereditary tendency; assigned cause; depressing influences. In mammary tumors, number of children; date of birth of last; if ever suckled with affected breast, when? condition of the catamenia, if ceased, how long? Previous treatment, and success.

PRESENT CONDITION AND APPEARANCES.—Position of tumor; size, shape; external aspect and condition of skin; pain, and its character; condition of lymphatic glands; manipular indications; mobility, when in breast, whether moved by traction of the nipple; feel, hard, elastic, &c., &c. Constitutional symptoms.

TREATMENT.—In recurrent growths give the date of former operations, date when healed, and of its first reappearance and position.

OPERATIONS.—Describe position, direction, and number of external incisions; the steps of the operation as performed; its duration; number of vessels tied or twisted, and amount of hemorrhage. In amputations the part amputated, and position of amputation. In flap operations give the position of the flaps; whether anterior, posterior, or lateral; whether performed by perforation or external incision. In the combined flap and circular note the position of the skin flaps; in all, note the result and character of stump.

CHAPTER I.

ON REPAIR AND INFLAMMATION.

THE repair of wounds after injury is a subject of so much importance to the surgeon that I have thought it well to devote an early chapter to its consideration; for, as the surgeon's aim in practice is to place wounded parts, whether hard or soft, in the most favorable position for repair, and to remove all obstacles that are likely to interfere with the natural evolution of the process, it is incumbent upon him to know how nature proceeds in carrying out her end under different circumstances, in order that he may in no way by acts of omission or commission interrupt her in the performance of that desirable object. My remarks must, however, necessarily be brief.

As a primary truth, well worthy of remembrance, it may with confidence be asserted that, under all circumstances, the processes of repair are

identical in all tissues; that in bone or muscle, integument or tendon, soft or hard parts, the reparative process is the same, only such modifications showing themselves as necessarily appertain to the anatomy of the tissue or special circumstance of its position. Thus, tissues that are highly vascular may undergo more rapid and more perfect repair than others less fortunately circumstanced, and bone tissues may require more time to unite than skin, but in all, the process is alike.

Let us now inquire what the process is—what changes take place in the parts that are undergoing repair. These are best seen when an incision is made through the skin and the edges are brought together. Let us see what they are.

The chief points that can be observed have reference to the capillaries, and in these, at the margin of the wound, the blood will be found coagulated up to the nearest anastomosis, and the capillary vessels in the neighborhood will be seen dilated; this dilatation being caused by the increase of pressure to which the capillaries have been subjected by the altered circulation of the blood in the immediate vicinity of the wound. No other changes than these take place when wounds unite by *immediate union*, beyond the gradual restoration of the capillary circulation through the parts that have been divided. And under these somewhat rare circumstances no scar or cicatrix is left. The soft parts at first simply adhere together, and subsequently become continuous.

Should the wound unite by what is called *adhesive union*, or *primary adhesion* (the “first intention” of John Hunter), in which a cicatrix is formed, other changes are to be seen. These are found in the connective tissue—one that pervades every other, in which the vessels of the part ramify, and which is made up of cell element and intercellular tissue, the cell element varying according to the nature of the part in which it is found.

In the reparative changes which we are now considering it is the cellular element of the connective tissue that must be observed; and the practical point to which I would draw attention is the cell multiplication. Whether this multiplication depends upon changes in the cell itself, as Virchow affirms, or whether the cells are direct exudations of the white corpuscles from the capillaries, as Cohnheim would lead us to believe, I do not purpose stopping to inquire, but rather accept the fact of their existence, which all admit. (*Vide* Fig. 1, page 28.)

Under these circumstances, we find between the edges of the wound a vast accumulation of cells, filling up in various degrees the spaces of this wounded tissue, and through these cells cicatrization takes place.

Let us now consider briefly how cicatrization proceeds, and it is to be noted that the most important changes are to be recognized in the cells. Those nearest the tissue gradually assume a spindle shape, the intercellular tissue into which these spindle-shaped cells are infiltrated becoming denser. The spindle-shaped cells gradually change into ordinary connective-tissue-corpuscles, and in this way new cicatricial tissue is formed. This new tissue, however, again undergoes changes—changes of consolidation. The intercellular tissue becomes gradually more condensed. The spindle-shaped cells gradually assume the flat shape of connective-tissue corpuscles, and in a measure disappear, the nucleus often alone remaining. The fluid that existed in the newly formed tissue becomes absorbed, and the new cicatrix by degrees becomes firmer and denser, gradually contracting, so that at last the delicate scar of a large wound becomes solid and compact; the cicatrix in smaller wounds appearing only as a thin red, and at a later period a white line.

Changes in the capillaries of the part are, however, going on during all this period, and how far *all* the changes that have been briefly described are due directly to the capillary action is not yet determined. If Cohnheim's views become established, it is to them that the chief action in the tissues must be ascribed; if those of pathologists, such as Virchow and Billroth, are adopted, the capillary action will take a secondary place, acting through the cell-elements. But on either theory their importance cannot be overlooked.

We have seen how at the beginning of the reparative process the capillaries of the part become sealed, and the collateral circulation in the neighborhood becomes irregular and pressed upon. As repair goes on we can see that the coagula in these obliterated capillaries become reabsorbed or possibly reorganized; for it is tolerably certain that the capillary network soon becomes continuous through the newly formed cicatricial tissue, the capillary meshes of the one side joining by loops projected through the new tissue with the same meshes of the opposite one.

What influence the nerves of the part have upon the reparative process we know not. That they have an important influence there can be little doubt, for all physiologists recognize their power upon secretion and nutrition, and the vaso-motor nerves doubtless have the greatest power. But we must learn something more of nerve-power generally and nerve distribution—something of the way in which the nerves terminate in the tissues, and what relation they bear to the capillaries—before we can hope to find out or understand the influence nerve supply has on repair.

All wounds do not, however, heal by immediate union, primary adhesion, or first intention, and wounds that gape cannot. The process of repair in these, therefore differs, somewhat in its character from those we have been considering; it *takes place by granulation*, or the “second intention” of Hunter. If we closely examine the surface of a wound thus exposed, we shall find that it becomes within a few hours of its exposure covered with a film of a peculiar gelatinous, grayish-white appearance, and if we examine this with the microscope, it will be seen to be composed of granulation-cells or white blood-cells. If the edges of the wound at this time be brought together, union may take place, the name of *secondary adhesion* being applied to this form of healing. As hours pass the parts covered by this gelatinous grayish film become more vascular, as indicated by redness, and the surface becomes more even. The film itself assumes a tougher character, and the wound secretes a yellow fluid, this fluid being mixed with small yellow sloughs of fibrinous tissue. The wound begins to “clean,” and to have a smooth and consistent surface. After the lapse of another day, or some days, perhaps, this surface becomes covered with a number of elevations, varying in size from a millet-seed to a hemp-seed, the smaller ones being highly vascular and red, the larger being, as a rule, paler and more bloodless; these elevations are called *granulations*. The wound at this time is granulating. The secretion from these granulations is now of a creamy-yellow character, and is called *pus*. These elevations are made up of cells, called granulation-cells. They are like inflammatory lymph-cells, and are very vascular. Each granulation contains a vessel, the walls of which consist of a thin membrane, in which nuclei are imbedded. “Some of these nuclei are arranged longitudinally, others transversely, to the axis of the vessels. In the development of these vessels changes occur, answering to those seen in ordinary embryonic development. Organization makes some progress before even blood comes to the very substance of the growing part; for the form of cells may be assumed before the granulations become vascular. But for their continuous active growth and development,

fresh material from blood, and that brought close to them, is essential. For this the bloodvessels are formed, and their size and number appear always proportionate to the volume and rapidity of life of the granulations. No instance would show the relation of blood to an actively growing or developing part better than it is shown in one of the vascular loops of a granulation imbedded among the crowd of living cells and maintaining their continual mutations. Nor is it in any case plainer than in that of granulation, that the supply of blood in a part is proportionate to the activity of its changes, and not to its mere structural development. The vascular loops lie imbedded among the simple primary cells, or when granulations degenerate among structures of yet lower organization; and as the structures are developed, and connective tissue formed, so the bloodvessels become less numerous till the whole of the new material assumes the paleness and low vascularity of a common scar." (PAGET.)

If we look to the margins of the wound at this time, when the granulations have attained to the level of the skin, a dry red band of newly formed tissue will be seen, which on its outer border assumes a bluish-white color, where it comes into contact with sound integument. This band is the new skin forming; it is caused by the gradual growth of the epidermis from the margin of the sound skin towards the centre of the sore. This process is called *cicatrization*. The cicatrix is red at first, as is the linear cicatrix to which we have already alluded. It subsequently becomes paler, and more compact and adherent, gradually contracting. The nature of the scar or cicatrix varies with the tissue in which it is formed, the new connecting medium or cicatrix under all circumstances having a powerful tendency to adapt itself to the peculiar character of the tissue in which it is placed. Thus, a cicatrix in skin becomes in time like true skin, a cicatrix in bone like true bone, and when connected with a divided tendon it becomes tough and hard like tendon; the consolidating reparative material in every instance partaking of the character of the parts with which it is connected. It is corpuscular in its origin, but clearly fibrinous in its nature. Whatever its origin may be, and about this men widely differ, its existence is undoubted, and through it and by it all repairs take place.

When wounds *heal by scabbing*, granulations do not form. It would appear that the reparative material which is poured out undergoes at once changes similar to those we have described as taking place in adhesive union, the wound cicatrizing rapidly beneath the scab. The serum of the blood when effused on the surface of a wound is of a highly plastic nature, rapidly coagulating to form a film of a protective nature, under which repair may rapidly proceed. Advantage is taken of this in the treatment of superficial wounds; the value of felt, cotton-wool, or any such like material, when applied to an open wound, entirely depending upon this plastic blood property. It is doubtless the best form of healing, although it is unfortunately somewhat rarely seen.

The *healing of subcutaneous wounds* must be somewhat similar. Some details of this process will be given in the chapter that treats of tendons.

I propose now to consider some of the *causes that interfere with repair*, and amongst the most frequent, hemorrhage must be placed. Blood, if effused to any extent between the edges of a wound, must of necessity interfere with the reparative process; it will forbid all healing by immediate union, and may interfere with healing by primary adhesion. If effused in very small quantities between the divided surfaces, it is possible it may at times change into cicatricial tissue, and form a bond of union between the divided parts; in certain other instances it may organize, as on the

brain. If effused to any great extent it will probably break up and act as a foreign body, causing irritation and inflammation.

If *foreign bodies* exist between the edges of a wound, union cannot go on.

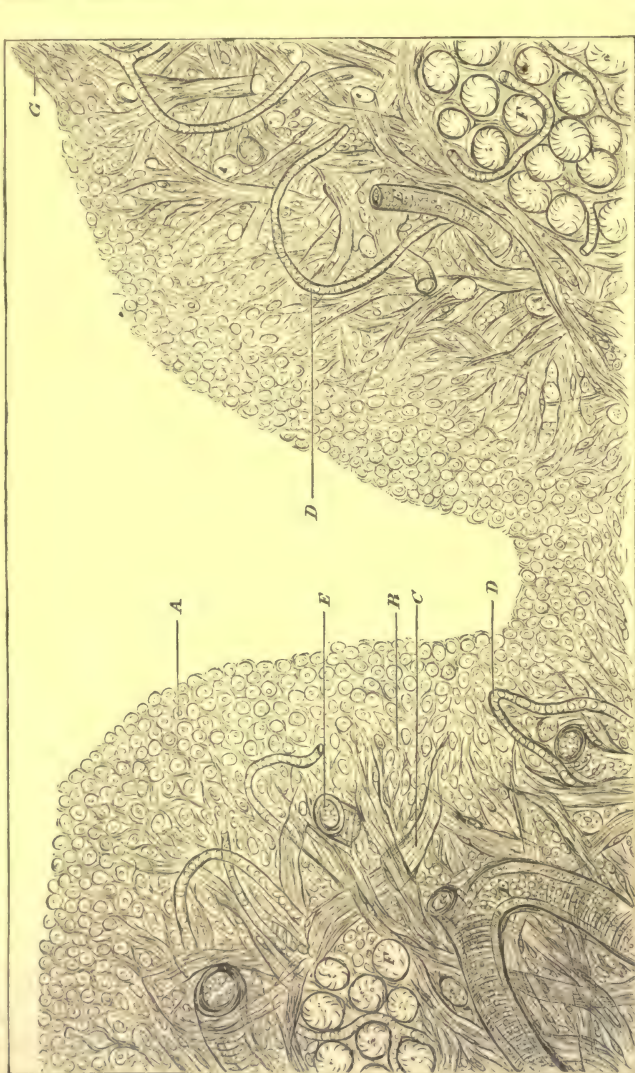
If the *wounded parts are much contused*, union can only take place by granulation or second adhesion.

If the *edges of a wound are allowed to gape*, or have too much tension upon them, the same observations apply.

If the *injured parts are not kept quiet*, repair cannot go on, as is best exemplified in fractures.

FIG. 1.
DIAGRAM ILLUSTRATING THE PROCESS OF REPAIR IN A WOUND FILLING UP BY GRANULATION.

(This drawing has been made for me by my friend, Mr. Howse, from microscopical sections of granulation in his possession.)



A. Granulation-cells with single or double nuclei. These, when shed, become spindle-shaped. B. The same cells becoming spindle-shaped. C. Intercellular element becoming developed into bundles of white fibrous tissue. D. Capillaries. E. Small arteries. F. Fat-vesicles forming lobules. The two last structures constitute part of the original subcutaneous tissue. G. Superficial cells becoming converted into epidermal scales.

If *too little action* is present from deficiency of power, as we see in the very old and the very young, in plastic operations and the non-union of

fractures, &c., union will not take place ; and a like result ensues when *too much action* exists.

I shall next consider what too much action in a wound means ; how it is to be recognized clinically and pathologically ; and what are its results.

It is generally known by the term *inflammation* ; and as this process, whether it affects a wound or any other part, is to be recognized by its own symptoms, I shall speak of it generally. As it affects a wound, so it affects other tissues ; consequently the consideration of the former will help to illustrate the latter.

When a *wound is inflamed* there are four points that strike the attention. The first is *redness* of the edges of the wound. This may appear as a mere blush on its border, or may extend far and wide all around. It may be of a bright red color or of a livid hue. The former tint is generally regarded as indicating a healthy or *sthenic inflammation*, the latter an *asthenic*, indicating want of power. The redness is doubtless due to the capillary injection of the part ; and as we have already seen that in the repair of wounds capillary injection is a necessary attendant, so the redness of inflammation in a wound is simply the result of this carried to excess.

The second point is clearly connected with the first ; indeed, it may be regarded as a result. It is *increase of heat in the part* ; increase of action, as indicated by excess of vascularity, being generally accompanied by this symptom. There is reason to believe likewise that the blood is also overheated.

The third point is likewise a striking one, and is clearly a result of the capillary injection, to which notice has just been drawn. It is *swelling of the inflamed part* ; this swelling showing itself either as a simple œdema of the edges of the wound, or as a more or less general diffused infiltration of the parts. This swelling is apparently produced by the passive exudation of the serum of the blood into the cellular tissue of the inflamed part, from the stagnation of the blood in the overloaded capillaries in the neighborhood of the injured tissue.

The fourth point is *pain*, this symptom varying much as to its intensity, and apparently depending a great deal upon the amount of swelling in the inflamed part, and its tension. In inflammation of the bone, periosteum, or any unresisting fibrous tissue, as the sclerotic of the eye, the pain is intense ; in rheumatism it is also well illustrated. It is probably caused by direct pressure on the extremities of the nerves of the part by the swollen tissue. It may show itself simply as an increase of sensibility of the part or as a severe agony.

We thus have *redness, heat, swelling, and pain*, as symptoms of overaction of a part, or of what is called *inflammation*, and they, one and all, appear to be direct consequences of extreme capillary vascularity of the tissue, whether the result of a wound or not. They may manifest themselves in every degree of severity ; their extent depending upon the intensity of the inflammatory action and the tissues that are involved. When a loose tissue is involved the redness will be much marked, and the swelling will probably be rapid ; but pain will certainly be slight, as the tension of the part is rarely severe. When the connective tissue situated beneath a dense fascia or skin is involved, the redness and swelling are, as a rule, but little, for the peculiarities of the part affected prevent their being manifested ; but pain will probably be severe, for the tension of the tissues, and the pressure upon the nerves of the part will, under such circumstances, be necessarily great.

When the inflammation is *acute* or rapid, all these symptoms manifest themselves with great rapidity, and the results of the action are quickly

shown. When slow or *chronic*, their manifestation is less rapid, although equally well marked.

With these local symptoms of inflammation there will always be associated some *disturbance of the function of the inflamed part*, or probably its arrest; and what is of equal importance, some constitutional disturbance, which goes by the name of *inflammatory fever*. This fever may manifest itself in all degrees of severity, its intensity depending much upon the character of the inflammation and its seat. When the local affection is *acute*, or of a *sthenic* nature, the constitutional disturbance will be severe; when *chronic* it will probably be but little; and when *asthenic* it will be marked by great depression. This fever may show itself, therefore, only as a slight febrile state, or it may be marked by the severest symptoms.

The following description may be taken as a type of the affection:

"Taking, for instance, a case of severe compound fracture, without much hemorrhage, in a person otherwise sound and strong, we find that, before twenty-four hours have elapsed from the time of injury, his general system begins to be thus affected. He feels hot, or alternately very hot and chilly. His skin and lips and mouth are dry. He passes urine in less quantity, but of a higher color, than usual. His pulse is quickened. A sense of general disorder gains upon him. He becomes restless and intolerant of disturbance. Signs of drought increase with him. His urine becomes scantier and more colored. His skin feels hotter to the surgeon's hand, and his pulse, whether full or hard, is quicker and stronger than before. He craves more and more for water. His face has a flushed, anxious look. He is thoroughly uncomfortable; for the most part feeling distressingly hot, but at irregular intervals feeling touches of chilliness—sometimes even of such cold that he shivers with it. His sleep is troubled and unrefreshing; or, as night comes on, he gets delirious. His tongue, besides being dry, is furred. If his bowels act (which commonly they are inapt to do without laxatives) the excretions are morbidly offensive. Gradually these symptoms give way; in proportion as the injured limb ceases to be tense, and passes into suppuration, the skin and mouth become moist again; the excretions lose their concentrated character; the hard pulse softens, and the heart's action becomes quiet; the nervous system is no longer restless; the look of trouble passes from the countenance, and the patient can again take solid food."

The description just given of the symptoms of inflammatory fever purports only to represent the chief facts of a typical and uncomplicated case. It is so graphic that I have taken it from Simon's masterly article in Holmes's "System of Surgery," 2d edition, vol. i, p. 21.

There can be little doubt that these symptoms are clearly due to an increase in the temperature of the blood, and that their severity is measured by it. This is, indeed, as Simon has so aptly expressed, "the essential fact of inflammatory fever. It is to this fact that the familiar language of feverishness bears witness,—the thirst, the scanty urine, the heat, and the shivering, the troubled brain, the excited circulation. As the blood gets hotter and hotter, more and more do these symptoms become developed. As the blood subsequently gets cooler so, more and more, do they decline."

It seems from Dr. Montgomery's observations, made for Mr. Simon, that "febrile excesses of bodily temperature range perhaps to ten degrees above the normal heat of the blood; the 'crisis' of a febrile state consists in a rapid and generally continuous reduction, the 'lysis' in a slow and generally discontinuous reduction, of this abnormal temperature." With respect to the causes of this greater heat of blood, the results of inquiry seem to show "that either continuously during the intensity of feverishness, or

else more abruptly when feverishness begins to subside, there can commonly be traced in the excretions an excess, more or less considerable, of those nitrogenous, sulphurized and phosphorized, products which emanate from textural and humoral waste; that this increased elimination is observed even when ingestion has been reduced to a minimum; and that febrile excretions do, therefore, as a rule, undoubtedly attest an increased devitalization of bodily material."

It seems highly probable that the blood, under these circumstances, contains more than its normal complement of fibrin, and that it coagulates with what is generally described as a "buffy coat." There is good reason also to believe that this "buffy coat" is due to the fact that the blood-corpuscles subside in the liquor sanguinis during the coagulation, leaving the upper portion of the clot colorless. What the meaning of this increase of the fibrin in the blood in inflammation may be is a question that remains to be decided. Some pathologists believe that the blood is excellent in proportion as it is fibriniferous; that solidifying fibrin is almost incipient tissue; that the fibrinous crust, as drawn in inflammation, is the sign of its being specially adapted to the purpose of additional growth; whilst others believe, and Simon, from whose writings this quotation is made, ranks amongst them, "that the blood yields more fibrin, not in proportion as it is ripe and perfect, but rather in proportion to quite opposite conditions; that an increased yield of fibrin portrays not perfection, but post perfection in the blood; that it corresponds not to the rise, but to the decline of albuminous material; that the relations are not with repair, but with waste; that its significance is that of something intermediate between life and excretion; that the fibriniferousness of the blood is undiminished, probably even increased by bleeding; that it is greatly developed during starvation, during violent fatigue, during diseases essentially anæmic; that its increase, under these circumstances of exhaustion, weakness, and inanition, is to the full as great as its increase during inflammation."

"These latter views seem to be most in accord with truth and with the general chemistry of inflammatory fever. They seem to indicate that the fibriniferousness of the blood in inflammation represents action of devitalization and decay in some albuminous material. Whether this changing material be the inflamed texture gradually dissolving itself into the blood, or be the albumen of the fevered blood itself undergoing accelerated waste, cannot in the present state of knowledge be even approximately stated." (Simon.)

With this brief description of the phenomena of inflammation and inflammatory fever, I propose now to consider the *results of inflammation on a part, or excess of action.*

When inflammation attacks a wound, or excess of action exists in it, repair is interfered with, retarded, or destroyed, in proportion to its intensity. For the immediate union of a wound, and healing either by scabbing or by secondary adhesion, anything like inflammation of the part is fatal. In primary adhesion and in healing by granulation, an inflammation sufficient to pour out the primary cell tissue—plastic reparative matter, granulation tissue of Virchow, embryonic tissue of Rindfleisch—does not appear to be injurious; but it must not go beyond this point. Here the natural reparative action of a part and inflammatory action seem to accord; the former being without doubt a healthy process, whilst the latter seems to be the former running to excess.

When acute inflammation attacks a wound, either of the soft parts or of bone, there is an end to all repair, and partial union may be changed into complete disunion. The inflamed tissue may die, wholly or in part. When

soft tissues die they are said to *mortify*; when this action is a spreading one it is called *gangrene*, or *sloughing phagedæna*; and the dead part that is thrown off is known as a *slough*. The death of bone is called "*necrosis*," and the dead piece of bone a "*sequestrum*." When a portion of tissue dies, the dead piece is thrown off by a process known as that of *ulceration*; when the ulceration spreads, an *ulcer* is said to exist; when this undergoes repair, it does so by *granulation*. Ulceration of a part means its molecular death.

There is, however, a low or asthenic form of inflammation that attacks a wound, which differs in a measure from that we have been considering. It usually comes on at some late period of the healing process, and manifests itself by clinical phenomena of a subdued character. Redness will be present, but it will not be of a vivid, but of a dull and dusky nature; swelling will exist, but it will be of an œdematous kind; the pain will be dull, and the discharge serous or sero-purulent. It affects repair as injuriously as the more sthenic form, and is found in subjects of feeble and depressed powers.

Such, then, are the chief local effects of inflammation on a wound; but there are others of no little importance to which attention must be drawn, and the principal one refers to the inflammatory exudation into a part.

We have already stated that when inflammation attacks a tissue, swelling is one of the chief clinical signs, and this swelling is, without doubt, directly caused by effusion. The character of this effusion varies with the activity, character, or specific nature of the inflammation. When the inflammation is of a healthy or *sthenic* kind, it will tend towards the fibrinous variety, producing plastic infiltration of the part; when of a feeble or *asthenic* form, the serous and corpuscular elements will doubtless predominate. In the former case the soft tissues will appear firm and dense; in the latter soft and œdematous.

In healthy subjects this plastic infiltration may be reabsorbed, leaving the tissue that had been involved perfectly sound, recovering by what is termed *resolution*, or it may become organized. In unhealthy subjects the infiltrating material may break up or degenerate, and give rise to what we know as *pus*. When this forms in a part, *suppuration* is said to have taken place. Inflammatory lymph may consequently be converted into pus. Paget has pointed out how, in amputating through a limb infiltrated with lymph, pus may flow from the wound in the course of a day; while it is known that in amputation through healthy tissue free suppuration does not usually appear till after three or four days. Under these circumstances the pus must have been formed by the conversion of the inflammatory lymph previously infiltrated into the divided tissues.

"When an inflamed part is cut, the first pus is from lymph; the latter pus—when repair is in progress—is from granulation substance. In both cases alike the pus manifests itself as a rudimental substance, ill developed or degenerated; and the transition from the one condition to the other is an evidence of the impossibility of exactly defining between the inflammatory and reparative processes, unless we can see their design and end." (Paget.)

"From these and like facts," says Paget, "we have an almost exact parallel, in their relation to pus, between the material for repair by granulation and that produced in the inflammatory process, and between, if they may be so called, the reparative and the inflammatory suppuration."

Dr. Burdon-Sanderson's investigations, as given in "*Holmes's System*," have led him to regard inflammation as due to excessive irritation of the tissues, this irritation setting up, 1st, disorder of the circulation; 2d, trans-

udation of blood constituents; and, 3d, alteration in the nutrition of the inflamed parts. Stasis of blood in the inflamed parts is the first effect of inflammation. This stasis, which is attended by the crowding together of the white corpuscles or leucocytes, is followed by their motion, and at last their passage through the capillary walls, and their accumulation in the tissues; the serum that exudes with them giving rise to swelling—these leucocytes forming the first purulent elements in the tissues. Cohnheim, indeed, considers these leucocytes as the sole source of purulent infiltration; but the facts before given fairly show that this cannot be the case, pus being probably a compound fluid of leucocytes and degenerated inflammatory tissue.

Pus itself is made up of a thin transparent fluid and pus-corpuscles. These corpuscles are globular, and larger than the white corpuscles of the blood. They are minutely dotted, and contain three or four small dark nuclei; these nuclei become clear by the addition of acetic acid, and contain nucleoli (*vide* Fig. 2). Acetic acid dissolves the nucleus of a white blood-corpuscle.

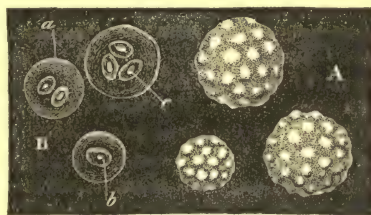
Pus is also dissolved in alkalis, and has an alkaline reaction. It contains from fourteen to sixteen per cent. of solids—chloride of sodium and phosphates. Dr. Day, of Geelong, has given us a new test for pus that is worthy of record. He prepares his test-fluid by exposing a saturated alcoholic solution of guaiacum to the air until it has absorbed a sufficient quantity of oxygen to give it the property of turning green when placed in contact with iodide of potassium. On moistening the most minute quantity of pus with water, and pouring a drop or two of the test-fluid over it, a clear blue color is produced.

By means of this test he has made out that healthy pus, when dried, becomes chemically inactive, and non-susceptible to the test, although when moistened with water it resumes its chemical activity; whilst pus taken from an erysipelatous, carbuncular, or pyæmic patient, retains for many months, although dry, its chemical activity, and responds to the test at once. He believes, consequently, that a moist atmosphere promotes the spread of erysipelas and allied affections, and that a dry one retards it. He finds that carbolic acid destroys forever the chemical activity of all pus-cells. ("Med. Times," March 11, 1871.)

The investigations of M. Schultze have proved that pus, when seen in a moist chamber and on a warm stage, exhibits very beautifully the amœboid movements; whilst those of Recklinghausen seem to indicate that the globular appearance of the pus-cell is a dead one.

For the further consideration of suppuration, see the chapters on Abscess and Ulceration.

FIG. 2.



A. Pus-corpuscles (magnified 350 diameters).
B Same made transparent with acetic acid.
a. Cell wall. b. Nucleus. c. Nucleolus. (After
LEBERT.)

CHAPTER II.

ON TRAUMATIC FEVER, SEPTICÆMIA, AND PYÆMIA.

Inflammatory Fever; surgical, suppurative, or traumatic fever; septicæmia, ichoræmia, puerperal fever, and pyæmia, may all be considered as so many different names for, and manifestations of, one condition—*blood-poisoning*. In inflammatory and surgical fever “the returning fluids of the inflamed part, its venous blood, and its lymph, are the agents of general infection” (Simon), the poison being probably derived from disintegrated tissues and generated from within the body. In septicæmia, ichoræmia, puerperal fever, and pyæmia, the absorption of putrid inflammatory products, whether from a wound or otherwise, of pus or pus-forming material, or of some other poison, is the undoubted cause. The poison under these circumstances is taken into the body, either by the veins or by the absorbents from without; traumatic fever passing into septicæmia, and this into pyæmia, the first being the mildest form of blood-poisoning; the last the most severe; the one generally ending in recovery, the other by the formation of secondary abscesses, either within or without the body, and death.

One and all are ushered in by very similar general symptoms, and an outline of those seen in a typical example of inflammatory fever will be found in the last chapter; “but practically the affection shows numberless grades and differences and complications. First, there are wide differences of degree and character, for in proportion as the local process is less acute and less extensive there is less attendant febrility; and in proportion as the local process has to invade fewer successive strata of texture, the fever is of shorter course. On the one hand, it may be so slight as readily to escape notice, and may end within a few hours of its commencement; on the other hand, it may last in full force during many successive days, and may be so severe as to shake the patient’s life to its foundation; and, besides these differences, there are varieties of result, sometimes from complicative local conditions, sometimes from peculiar susceptibilities of the patient. If the wound become the seat of some large textural disorganization, with consequent soakage of putrefying material, more marked signs of *blood pollution* may be expected to mix with or supersede those of common inflammatory fever; the patient’s general state will then incline to be one of depression and apathy; his tongue will be more than commonly foul, and fetid diarrhœa will probably exist; or if, perchance, during the local process, it happen (as is especially apt to be the case where cancellous bone-structure is affected) that pus passes up a vein into the general stream of blood, the patient’s improvement is abruptly cut short by the *severe recurrent rigors and sweating of pyæmia*, accompanied by local signs of secondary suppuration in parts to which the pus is conveyed.” (Simon.)

Confirmed blood-poisoning, therefore, is characterized not only by all the symptoms of inflammatory fever, but by *severe rigors* breaking in upon the febrile symptoms; by *sudden and marked variations of temperature*, by *profuse sweats* and *great depression of the patient’s powers*, passing on to a typhoid condition. When these symptoms occur in the course of an attack of inflammatory fever, severe blood-poisoning is certainly indicated, and in proportion to their severity its nature may be interpreted, the most severe marking the worse form of pyæmia. We generally meet, moreover, in marked pyæmia with local signs of inflammation of some internal or external part of the body, this inflammation running on to the formation of

metastatic, or *secondary abscesses* as they are called. When an internal organ is involved in this disease the result is, as a rule, fatal. When suppuration attacks the integuments or extremities, although it may be severe, there is always a good hope of recovery, for it is an interesting clinical fact that these two different forms of the disease are rarely met with in the same subject. They are seldom combined. They may for clearness be separately called *internal* and *external pyæmia*, *acute* or *chronic*; for when pyæmia involves internal parts, its course is generally rapid and fatal; when it attacks external parts, it is, as a rule, chronic, although at times the latter may supervene upon the former variety.

In many cases of pyæmia a peculiar, sweet, hay-like odor of the breath is undoubtedly present. Some authors, and Braidwood is amongst them, look upon this symptom as pathognomonic.

Traumatic Fever generally makes its appearance from the second to the ninth day after an accident or operation, and seldom lasts over a week. In a simple case it may subside after twenty-four hours, and in a severe one it may continue for a week. When a *relapse*, or a second sudden rise of temperature takes place, grave mischief may be anticipated—some local inflammation, internal or external, being thus indicated. Billroth has described this second attack of fever as “*secondary fever*.” When it runs on for a more lengthened period than a week severe complications are sure to exist to keep up the symptoms. During its course the temperature of the body, naturally 99° F., may rise suddenly 5° or 6° F., and in ordinary cases its fall is, as a rule, gradual: with its fall defervescence takes place. Should the fall be sudden, a general breakdown of the powers of the patient is indicated, and under these circumstances sloughing of the wound may be looked for. The rise of temperature is generally accompanied by an arrest of secretion or some change of action in the wound, and the fall of temperature by its suppuration.

When blood-poisoning attacks a patient the subject of a wound, whether caused by operation or injury, it is generally to be observed that the secretion of the wound becomes sanious, serous, or fetid; probably it will be arrested, and the surface will become glazed or glassy, or perchance assume a sloughing action. The integument around the wound will often have an erythematous blush, or acquire a peculiar leaden, dusky appearance, which is somewhat typical. Union if progressing will cease or become disunion. When any internal organ is implicated, special symptoms indicative of disturbance of its functions will be present. When the *brain* is involved there will be sleeplessness or delirium of a low muttering kind, some unconsciousness from which the patient can be roused only to relapse—“*relapsing unconsciousness*,”—and in rare cases acute delirium and mania.

When the *respiratory organs* are involved—and it may be stated that they are so by far the most frequently—difficulty of breathing, with a harsh dry cough, and perhaps viscid blood-stained sputum, are the prominent symptoms; occasionally pleuritic pains are present, or symptoms of bronchitis, and great dyspnoea.

When the *abdominal viscera* are affected, nausea or sickness is a prominent symptom, and there is often profuse diarrhoea, this in some cases apparently carrying off the poison. When anything like sallowness of the skin or jaundice appears, hepatic abscess should be suspected; and, under these circumstances, there will often be pain in the region of the liver. At the same time the reader must remember that a slight degree of jaundice is often present without hepatic suppuration. The *urine* is rarely altered either in character or quantity; at times it is scanty and dark-colored. When severe or dull pains are experienced in a joint, its suppuration should

be suspected; for when pyæmia attacks any part, deposits of pus generally result, and anything like so-called rheumatic pains occurring in a patient under these circumstances becomes a source of suspicion; "rheumatic" pains in blood-poisoning too often meaning joint or bone mischief of a suppurative kind. It is remarkable, however, how slight the symptoms often are in these cases when severe local disease exists. This fact demands that the surgeon's careful and searching eye should ever be on the watch to detect anything like local changes; for it is a clinical and pathological fact that there is no organ or tissue of the body in which suppurative disease may not take place in a case of blood-poisoning or pyæmia; and it is certainly true that the existence of severe local disease is too often only first discovered on the post-mortem table.

What, then, it may be asked, are the *pathological conditions found after death* in a case of blood-poisoning or pyæmia—using this word in a general sense?

The analysis of 203 cases, which I have collected from the records of Guy's Hospital, with the sanction of my colleagues Drs. Wilks and Moxon, by whom all the examinations were made, and have condensed into a table seen at page 53, will give an answer to this question.

The Lungs.—The most prominent fact indicated by this table has reference to the lungs, for it proves that in the larger proportion of fatal cases of blood-poisoning these organs are implicated, and that in many they are the only parts involved. Lung mischief was found one hundred and eighty-seven times in two hundred and three cases; and in seventy-eight cases, or thirty-eight in every hundred, the lungs were the only organs affected. *Lobular pneumonia* is the form in which the disease is generally found; and when even a lobar pneumonia is present, it can usually be made out to have originated in lobules, and to have spread from them as centres. This lobular pneumonia, like the lobar form, is also generally seen in the *lower lobes*, and not at the apices, and nearer the surface than the deeper parts. The earliest indication of disease is a lobular pneumonia, and "subsequently," says Wilks, "these congested spots are found to contain inflammatory products, and thus we have red hepatization, gray hepatization, suppuration or sloughing." All these stages may often be seen in individual masses. With this lobular congestion or pneumonia some *ecchymosis* of the surface of the lung will generally be found—a purpuric condition in fact—strongly suggestive of blood-poisoning. Pleurisy, moreover, generally exists, the fact being accounted for by the superficial position of the lobular pneumonia.

The Liver, like the lungs, is attacked in its lobules. These may be found only congested, or in any intermediate condition between this the first stage, of inflammation, and the last, that of suppuration or sloughing. At times this organ is filled with small abscesses. When these abscesses approach the surface of the liver, they may burst and give rise to a general peritonitis. The liver is involved in this affection twenty-seven times in every hundred cases, and almost always in association with disease in the lungs. Thus, out of fifty-five cases in which the liver was affected, in only two were the lungs uninvolved. It would appear, likewise, from the table that the liver is more frequently the seat of pyæmic suppuration after injuries to the head than after any other affection, and that it is rarely found involved after diseases of the urinary organs and burns.

The Kidneys.—When the kidneys are affected, it is in the same way as the lungs and liver, small isolated points of suppuration being found, surrounded by a zone of congestion either on their surface or in their cortical structure. They are not affected so frequently as are the two former organs—not more so, indeed, than in seventeen cases out of one hundred. They are more frequently found involved after disease of the urinary organs than

ANALYSIS OF 203 FATAL CASES OF PYÆMIA.

Nature of accident or disease.	Number of cases.	Lungs.		Liver.		Kidneys.		Spleen.		Brain.		Heart.		Joints.		Cell-tissue.	
		Cases.	Alone. ¹	Cases.	Per ct.	Cases.	Per ct.	Cases.	Per ct.	Cases.	Per ct.	Cases.	Per ct.	Cases.	Per ct.	Cases.	Per ct.
Compound fracture,	26	23	11 _{42.3}	9	34.6	3	11.5	1	3.8	—	—	—	—	4	15.3	3	11.5
Amputation after compound fracture,	38	34	14 _{36.9}	15	39.4	2	5.2	6	15.7	—	—	—	—	4	10.5	3	7.8
Amputation for disease,	29	24	14 _{48.2}	6	20.6	2	6.9	2	6.9	2	6.9	—	—	2	6.9	4	13.8
Injury to scalp and skull, . . .	11	11	1 ₉	7	63.6	—	—	—	—	5	45.4	—	—	1	9.	2	18.1
Inflammation and suppuration of soft parts,	33	30	9 ₂₇	8	24.2	8	24.2	5	15.1	2	6.	5	15.1	8	24.2	5	15.1
Disease of urinary organs, . . .	22	22	11 ₅₀	—	—	10	45.4	—	—	1	4.5	1	4.5	—	—	1	4.5
Disease of bones and joints, . .	28	27	9 ₃₂	6	21.4	8	28.5	4	14.2	—	—	4	14.2	6	21.4	2	7.1
Operations on soft parts,	5	5	2 ₄₀	1	20.	1	20.	1	20.	—	—	1	20.	—	—	1	20.
Carbuncle,	6	5	2 ₃₃	3	50.	2	33.3	—	—	1	16.6	2	33.3	—	—	—	—
Burns,	5	5	5 ₁₀₀	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL,	203	186 or 91.6 per cent.	78 or 38.4 per cent.	55 ²	27.	36	17.7	19	9.3	11	5.4	13	6.4	25 ³	12.3	21	10.3

¹ In which the lungs were alone involved, with per cent.² Alone in two cases only, in all others lungs involved.³ Sterno-clavicular in eight.

any other, and after suppurative disease of the cellular tissue, particularly that surrounding the shafts of bones.

In the *spleen* large abscesses are often present. Suppuration may likewise be found in the *brain, heart, prostate, testis, tongue, thyroid gland*, and, in fact, in any portion of the body. In the cellular tissue of the body and extremities a diffused suppuration is very common, and it is too common in the joints.

When inflammation attacks serous membranes, such as the pleura and peritoneum, there seems good reason to believe that it does so from the extension of disease from the lung, liver, or spleen; but in the joints no such connection can be made out. The sterno-clavicular articulation is more frequently involved than any other, for I find that out of the twenty-five instances in which joint complication existed, this was involved in eight; but any joint may be affected. In some cases the articulation is only filled with an increase of synovia, in others the contents are more purulent—sometimes pure pus. At times the pus in the joint appears to be so slightly irritating that the cartilage and the synovial membrane are uninjured by its presence, whilst at others it is so destructive as to produce complete disorganization, the bones forming the joint being under these circumstances exposed, and at times necrotic. When these changes occur they are, probably, sometimes due to acute articular ostitis.

The skin has sometimes a *vesicular* or *pustular eruption* upon it, and too commonly *purpuric spots* or patches are present, which at times go on to mortification; and in connection with this subject “we may mention another evidence of the blood disease in the rapid decomposition of the bodies and the markings of the veins on the surface. Thus, before the body is scarcely cold, there may be sometimes seen the blue and red coursing of the veins and the coloring which has exuded from them into the tissues.” (Wilks.)

Lastly, it is to be remarked that it is exceptional to meet with any evidence of *phlebitis*, general or local; and this leads me to consider, although briefly, the now already abandoned and untenable theory that phlebitis, or inflammation of a vein, is the cause of pyæmia.

The most telling fact against the theory is the one fact mentioned, that it is only in exceptional cases of pyæmia that any evidence can be found of phlebitis; and the second is almost as strong, for “so far from phlebitis being a cause of pyæmia, it is remarkable how often the former occurs without any contamination of the blood whatever; that is, if we can call that phlebitis where we find a vein and its branches quite closed by coagulum or adherent fibrin” (Wilks); indeed, “it is a question whether, in those cases in which the veins are plugged or inflamed, thrombosis and phlebitis are not the local, and pyæmia the general effect of the same cause” (Savory)—blood infection. In this view I cordially agree.

That blood-poisoning may take place through veins is highly probable, but not from their inflammation, as we have just shown; neither is it probable that the absorption of pus, as pus, is the usual cause; for when pus mixes with blood coagulation is produced, and thus its circulation is prevented. There seems, however, good reason to believe that the fluid portion of pus or of some decomposing inflammatory product may be taken up by the veins and carried into the system, and thus cause pyæmia; a small vein or a large one, when involved in a suppurating or sloughing wound or abscess, more particularly when connected with an inflamed or divided bone, importing into the general circulation the poisonous element that by its presence sets up the disease. When the subject of phlebitis comes to be considered, other points bearing upon the theory will be explained.

The milder forms of traumatic fever are caused by the circulation of

morbid elements, taken into the blood either from within or without the body, and carried off, sometimes by the lungs, at other times by the intestines. The more severe forms, as pyæmia, are clearly caused by embolism, the secondary or metastatic abscesses which are found in the tissues being due to the presence of some blood poison, some "pus-germ," which has been arrested in its course, and become the centre of the morbid changes that are seen in the different tissues after death; arrest of the circulation being caused either by embolism of the capillaries of the part from the impaction of some circulating solid particles, or from the coagulation of the blood, or extravasation caused by its admixture with some morbid fluid. This view receives also much support from the fact, that disintegrating fibrin may be carried through the system by the heart or arteries into the smaller vessels in the parenchymatous organs, and give rise, not only to constitutional symptoms much akin to those present in the pyæmia just described, but to analogous pathological conditions. Thus in the "traumatic or venous pyæmia" lobular suppurative changes take place in the viscera or other parts, and in "arterial pyæmia" lobular fibrinous changes occur. In the former case secondary abscesses are found after death, in the latter secondary fibrinous deposits; although it seems probable that at times these fibrinous deposits may break down and give rise to abscesses.

This arterial pyæmia is common after rheumatic endocarditis, and is, doubtless, the cause of the so-called rheumatic pains that follow scarlet fever. In both of these classes of cases it is well to recognize the fact that embolism of large vessels is not uncommon. I have had to remove a leg on two occasions for gangrene from embolism of the femoral artery after scarlet fever. It is not difficult, therefore, to believe that capillary embolism may frequently exist in the same class of cases. This arterial pyæmia is not necessarily fatal. Mild attacks come and go, says Wilks, "the proof being found eventually in the cicatrices and remnants of deposits met with in the organs of the bodies of those who have died with heart disease." The mild forms manifest themselves by pyrexia, prostration, and pains in the joints.

Thus, when a patient dies rapidly from blood-poisoning, the only pathological change found in the tissues may be some lobular congestion of the lung, indicating the first stage of pneumonia; when life has lasted longer, red or gray hepatization may be present; and in a later stage lobular supuration; these different conditions depending upon the intensity of the disease and its duration. "The first stage of the morbid condition which is produced in the viscera is a coagulation in the vessels, and the last stage is a supuration." (Wilks.)

In feeble patients who have no resisting power against disease, it is possible that even these pathological conditions may not be found; life being, as it were, suddenly destroyed in the first onset of the blood-poisoning. Under these circumstances no definite post-mortem appearances would be seen beyond, perhaps, a general softness of the viscera, or some purpuric condition.

Duration of the Disease.—There seems reason to believe that a patient may die in two or three days after the first appearance of the symptoms; as a rule, bad cases terminate during the second week. Some go on for six or seven weeks. The longer a patient lives the better are the hopes of a successful ending.

Prognosis.—In every case of blood-poisoning great cause for anxiety exists, it being impossible to foretell its course or its end; for in one case, a small dose of the poison will prove fatal, while in another a full dose will be thrown off. The violence of the attack does not apparently depend

upon the severity or size of the wound; for a trifling wound is at times followed by urgent symptoms, and a severe local injury, at others hardly followed by any complications. Indeed, it does not depend upon a wound at all, for the severest cases of blood-poisoning are found in those in whom there is no wound; a slight injury under certain circumstances, or no injury at all, being followed by the severest symptoms.

A robust subject, doubtless, has a better chance of recovery than a feeble one, and an abstemious one than a drunkard. Where diseased viscera exist, the prospects of recovery are poor indeed, the capabilities of a patient to resist any diseased action under these circumstances being slight in the extreme; a man with healthy viscera, more particularly healthy kidneys, may have a sharp attack of traumatic fever and throw it off, when another with diseased organs would have succumbed. A single attack of traumatic fever may pass off without trouble, but a relapse or second attack always indicates mischief. Rigors rarely occur without suggesting the presence of some secondary deposit or local inflammation; and every repeated one should be interpreted in the same way. One rigor may pass off and leave no trace of harm behind, but when repeated they are associated too frequently with the gravest local complications, such as secondary metastatic abscesses in some internal organ or external tissue. These abscesses also when they occur outside any of the three great cavities, are less dangerous than when they occur inside; where the viscera are involved, the hope of recovery is very slight. Acute disease is always accompanied with great danger; when it is chronic there is always more hope.

The occurrence of pyæmia in different classes of cases is well shown in the following tables:

Analysis of the 217 cases of Pyæmia.

Of 217 cases—

68 or 31.3 per cent. were after compound fractures as a whole.	
24 or 11. per cent. not amputated.	
44 " 20.2 " amputated.	
26 " 12. " "	were after amputation for disease.
28 " 12.9 " "	" after other operations.
21 " 9.6 " "	" after injury without operation.
60 " 27.6 " "	" after disease without operation.
{ 12 " 5.5 " "	" idiopathic.
{ 2 " .9 " "	" puerperal.

Through the kindness of Dr. Steele, who has aided me in this statistical investigation, I am able also to give the following interesting facts respecting pyæmia:

Out of 790 cases of compound fracture, 192 died, or 24. per cent.

68 of pyæmia, or 8.6 per cent.

Of 184 treated by amputation—

89 died or 47.7 per cent.

44 of pyæmia, or 23.9 per cent.

Of 606 treated without amputation—

103 died, or 17. per cent.

24 of pyæmia, or 3.9 per cent.

" 324 cases of amputation of thigh, leg, arm, and forearm for disease—

126 died, or 38.8 per cent.

26 of pyæmia, or 8. per cent.

Pyæmia is thus seen to be three times as fatal after amputation for compound fracture as for disease.

Out of 29,434 surgical cases admitted into Guy's during 10 years, there were 1749 deaths or 5.9 per cent.

203 of these were from pyæmia, or 11.6 per cent.; about one in nine of the deaths being from this cause.

But of the whole number of cases treated, pyæmia was fatal only in .68 per cent.

TREATMENT.—An unlimited supply of fresh air, simple nutritious food, and, where a wound or suppuration exists, the most thorough cleanliness, are the main points of practice to be observed in the treatment of every case of traumatic fever or pyæmia. Compared with these all others are of secondary importance.

The disease being due to a blood-poison, often taken into the body from without, it is the surgeon's duty to see that the patient's room is well ventilated, that it is neither too hot nor too cold, as both extremes are powerful depressants; that the air circulating through it is free, fresh, and fragrant; that the room is frequently purified by cleansing and disinfectants, large dishes of any disinfecting fluid being distributed about, and cloths saturated with the same; solid iodine exposed in a plate to the air is probably as good as any, and more persistent. Care must be taken that no drain poison or closet effluvium can possibly reach the room; and that all secretions are disinfected at once, indeed, passed directly into vessels containing disinfecting fluid, such as Condy's, or carbolic acid, chloride of lime, or chloralum. The wound should be kept clean, and care observed that all discharges are allowed free vent. Dressings, when employed to a suppurating or sloughing wound, should be saturated with disinfecting lotions, and changed every three or four hours. When possible, foul wounds should be irrigated, a stream of warm water containing a disinfectant being allowed to run over the surface. I know of no means so valuable for keeping a wound clean as this. When sloughing of the part exists, charcoal poultices are at times of use. Sponges should never be employed where pus exists, but rather tow or cotton-wool, which can be thrown away. Poultices, when employed, may be put on tow or oakum, both these materials, through the tar they contain, being disinfectants.

In simple, *uncomplicated traumatic fever*, when it stops within the ordinary bounds, and neither runs on nor returns in its severity, no special treatment is called for. Should restlessness exist, or pain trouble, a sedative dose of chloral, opium or morphia, may be given, either by the mouth, rectum, or skin, and beyond this nothing is needed. In more confirmed cases of suppurative fever, when systemic infection is declared, the vital energies of the patient must be maintained or stimulated, and everything that tends to lower them must be warded off; thus the administration of tonic medicine becomes a necessity, the preparations of iron being the best, but strychnine and quinine are likewise of great use. Some surgeons employ very large doses of quinine, and speak highly of it,—from ten to twenty grains being given at the first onset of pyæmia, and repeated every three or four hours,—and Dr. Goodhart's investigations ("Guy's Hosp. Rep.," 1870) seem to show that quinine in full doses helps defervescence. Stimulants must be given with caution, and their amount regulated by the wants of the individual case. When the patient's habits have been free, alcohol in some of its forms will be required, even in large quantities; but when abstemious a very moderate dose will be enough, a large one doing harm; and that form of stimulant is apparently the best to which the patient has been accustomed.

The diet should be as nutritious as possible, but its nature must depend upon the assimilative powers of the stomach. When meat can be digested it may be given, although sparingly; but the preparations of milk are undoubtedly the best. When a patient can take milk no better drink can be given, either alone or mixed with eggs or some spirit; cream may be added at times, or the concentrated Swiss milk; animal broths may likewise be freely used. When a patient refuses food, Liebig's extract of meat, or Darby's fluid meat, may be mixed with his beer or wine without his

knowledge; and when the stomach rejects nourishment it must be given by the rectum, an enema of beef tea and egg being administered every four or six hours. Ice may always be allowed in small quantities, as it gives comfort. When the nervous system is disturbed for want of sleep or otherwise opium may be given, small doses frequently repeated being better than large ones. Where enemata are used, laudanum may be mixed with them.

Should diarrhœa exist it must not be checked too suddenly, for in some cases of blood-poisoning it appears to have an eliminative tendency; it should be stopped only when telling on the patient's powers. To give remedies, however, with the view of eliminating the poison by the bowel is a rash practice, and cannot be recommended. The sulphites and chlorides in any of their forms do not appear to have any power to neutralize the poison in the blood; they have been, however, highly praised. The alkaline salts have likewise been strongly recommended, and of these the carbonate of ammonia is probably the best. When other tonics cannot be tolerated this may be selected; it is, doubtless, a valuable remedy. It may be given alone or with the liquid extract of bark. The alkaline salts have been recommended "to promote the changing and eliminating of the products of the retrograde metamorphosis of the tissues." (Savory.)

When secondary abscesses have formed in the cellular tissue and between the muscles they should be opened; but great caution should be observed in dealing with inflamed joints. When the presence of pus can be clearly made out it should be evacuated by a free incision into the joint, and care taken that no collection takes place; indeed the joint should be freely washed out with a stream of warm water colored with Condly's, or some other disinfecting fluid, such as carbolic acid, one part in forty. Soothing applications should at the same time be employed, poppy fomentations being probably the best.

When acute blood-poisoning has set in, it is almost needless to say that amputation of a diseased limb has no influence in checking the disease; nor has the application of caustics or cauteries to a wound; indeed, no local treatment is known by which the formation of secondary abscesses can be prevented. In chronic pyæmia, however, amputation is often of essential service.

How far Blood-poisoning can be prevented is another question, and as it is an important one it may be considered here.

Concerning the exciting cause of the disease nothing is known; it attacks the healthy as well as the cachectic; those surrounded by perfect hygienic influences, as well as those who are subjected to the most imperfect. It is not a hospital disease solely; for it is found in private as well as in public practice, and some of the worst examples of the disease are often brought into a hospital, and not generated in it. It is true that the cachectic, and those who are subjected to close and unhealthy atmospheres, are the more prone to its attack, and that overcrowding in small wards, bad ventilation, bad drainage, and bad feeding are known to have an injurious tendency, with every other influence that has a depressing action on the vital powers. It becomes the surgeon's duty, therefore, to ward off, as far as he can, all such influences. In cases of operation, when any time is allowed for preparation, the general condition of the patient should be inquired into; the surgeon should see that the excretory glands are performing their functions, and if not he should, if possible, correct them. The feeble must be strengthened by tonics and good nutritious food, and the supply of stimulants should be regulated in all. The intemperate must be brought to understand moderation, and to know that life cannot long be sustained by drink alone; he must learn that stimulants are chiefly of

value in assisting digestion and the assimilation of nutritious food. The urine under all circumstances should be examined for albumen; for although the knowledge of its presence would not deter the surgeon from performing an operation of necessity, to save life, it would affect his prognosis, and it would most certainly influence his decision in an operation of expediency. All patients after operation should be kept in absolute repose, the wounds kept clean, and lightly dressed. Everything that tends to procure rapid union must be considered good, and everything that induces or keeps up suppuration bad. Blood-poisoning and suppuration, whether with or without a wound, having a close connection, no one who has been in contact with any infectious disorder, such as erysipelas or scarlet fever, should be allowed to come about the patient; for there can be no doubt that there is some subtle connection between these poisons and pyæmia. And lastly, every cheering influence should be brought to bear on the mind of the patient, as well as on his surroundings; for amongst depressing agents predisposing to blood-poisoning, the effects of mental conditions are doubtless strong.

Hectic Fever.—There can be little doubt that surgeons of former times included under this title many cases of what we now call septicæmia, pyæmia, or blood-poisoning; and even at the present time it is an open point as to how far the symptoms which denote hectic fever are due to the absorption of some foreign element into the blood.

That it is always found in subjects who are the victims of destructive organic changes, chiefly suppurative, is an established fact; this class being that in which confirmed blood-poisoning is generally found. The physician meets with this condition in pneumonia, phthisis, empyema, abscess in the liver, kidneys, or ovary; the surgeon in suppurative diseases of joints and bones, in spinal disease, compound fractures, diffused suppurations, &c. In all classes of cases there is a destructive wasting and influence at work, undermining the patient's powers and producing general emaciation. The characteristic symptoms are of a remittent nature, and usually appear at least once daily, towards evening; but they may do so more frequently, indeed they are not unlike those of ague.

Febrile symptoms are always present, and a paroxysm of hectic may be said to commence with them. The fever may be more or less intense; the skin will be hot and dry, and the pulse rapid, but always feeble. The face will be flushed in a single patch, and the palms of the hands and the soles of the feet hot and burning. The tongue during the paroxysm may be dry, and great thirst will be present. There will, however, be no brain symptoms, no clouding of the intellect, no delirium. The febrile condition may be preceded by shivering or chilliness, but such symptoms are far from usual; they are, however, always followed by a *profuse and exhaustive sweat*. This sweating is indeed peculiar to the affection, for it bears no proportion to the febrile symptoms that preceded it. At the commencement of the disease the febrility may be so slight as hardly to be noticed, and yet the patient on falling to sleep and awakening will be bathed in perspiration. When the disease is at its height the cold, hot, and sweating stages may be well seen; but when it declines the febrile symptoms will be constant, although aggravated towards night, the morning "colliquative" sweats gradually becoming more profuse as life ebbs away.

At the early stage of this disease there may be no fever *between* the paroxysms. The tongue, dry during the attack, will be moist and clean, but towards the close, morbidly red, smooth, and sore, with aphthous ulceration. The appetite and assimilative powers are rarely much affected; indeed, till the powers are failing rapidly they are little altered. The skin,

at first supple and moist between the attacks, becomes harsh, dry, and covered with branny scales. The urine, always scanty and high-colored, becomes more so towards the close of the disease. The bowels are sometimes constipated, but more frequently loose, or diarrhœa may depress the system. Throughout the disease, however, the mental faculties remain intact. The bodily powers may be reduced to a minimum, but the mental will remain clear, and at times vigorous. During the whole disease sleep is usually obtained between the attacks. Death always takes place from exhaustion, bed-sores too frequently adding to its sorrows.

TREATMENT.—The removal of the cause of the disease is the only means by which its cure can be obtained. Under any other circumstance *relief* alone can be looked for or attempted, as the affection is one purely of exhaustion, the waste of the tissues being greater than their repair. The object of the surgeon must be to maintain the strength of the patient in every way, abundance of simple nutritious food being administered, with stimulants carefully adjusted to the special wants of the case—small quantities of food repeated at certain short intervals being the best mode of administration. Stimulants and food should be given together, the former in sufficient quantities to enable the latter to be digested.

Tonic medicine should always be given, and probably quinine is the best, for this drug has, doubtless, a power in checking febrile action, in keeping down the temperature of the body, and preventing sweats. It should be given in a full dose, five grains in the solid form, before the paroxysm. Iron and strychnine are also valuable drugs.

Diarrhœa, when present, should be checked by astringents, but opium should be sparingly employed, except to relieve pain.

With respect to the removal of the cause of the disease by operation, when it can be entertained there can be no difference of opinion between surgeons. When hectic exists and is established, it is clear that nature's reparative powers have been found wanting in their efforts to cure the local affection, and it is hardly probable that they will improve with the drain upon their strength still continuing. The surgeon's duty under these circumstances, therefore, doubtless lies in operative interference. If the disease can be removed, this should be done; delay is almost criminal. Let the source of irritation, weakness, and trouble be removed, and it is wonderful how rapidly the most feeble subject may rally after the operation. If the viscera are sound good hopes of a recovery exist under apparently the most adverse conditions; but if the kidneys are diseased, the prospects of recovery are but feeble.

Moxon, "Guy's Hosp. Reports," 1871.—*Wilks*, "Guy's Hosp. Reports" for 1861 and 1870.—*Lee*, "On Phlebitis." "Practical Pathology."—*Paget and Savory*, "St. Bart. Reports," vols. i and ii, 1865-6.—*Virchow*, "Cellular Pathology."—*Peck*, "St. George's Hosp. Reports," vol. iii.—*Billroth*, *Dr. Th.*, "Archiv für Klin. Chirurgie" (Langenbeck's), B. ii, vi, viii, ix.—*Bristowe*, "Trans. Path. Soc. Lond.," vol. xiii. Reynolds's "System of Medicine."—*Roser*, "Sydenham Soc. Year-Book," 1863, p. 192.—*Prof. O. Weber*, "Berl. Klin. Wochenschr.," 1864. "Year-Book," 1864, p. 227.—*Gibson*, "Brit. and For. Med.-Chir. Rev.," Jan., 1866.—*Cullender*, Holmes's "Syst. of Surg." 2d edit., vol. i.—*Sedillot*, "On Pyæmia," 1849.—*Arnott*, "Med.-Chir. Trans.," vol. xv.—*Braidwood*, "On Pyæmia," 1865.—*Griesinger*, "On Leukæmia and Pyæmia."

CHAPTER III.

ON TRISMUS AND TETANUS.

WHEN a patient is the subject of an uncontrollable spasmodic contraction of the muscles of the lower jaw, he is said to have "*trismus*" or lock-jaw; and when the same condition attacks other or all the voluntary muscles of the body, he is said to have "*tetanus*." Tetanus includes trismus, and generally begins with it; but trismus may be a local affection. It is found in children as a result of dentition, and in adults as a consequence of diseases involving the teeth, gums, or jaws. It is a spasmodic affection, produced by reflected irritation set up by a local disease. It is rarely associated with any constitutional disturbance, and is, for the most part, cured on the removal of its cause.

Tetanus is likewise generally associated with some local source of irritation, some wound or injury; it is then called "*traumatic*." When no external or visible cause can be made out it is denominated "*idiopathic*." When rapid in its course, it is called "*acute*;" when slow, "*chronic*"—and this division of the subject is the most practical one. The acute form is usually the result of an accident, and is generally fatal. The chronic is, for the most part, idiopathic, and is more curable.

Tetanus Nascentium.—Tetanus is met with in new-born infants, and is then known as *trismus nascentium*, or *tetanus infantum*. It usually comes on during the second week after birth, and may be so acute in its course as to destroy life in from ten to thirty hours; or so chronic that life may be prolonged to eight or nine days. It is a common affection in the West India Isles, and has been known to occur frequently in ill-ventilated lying-in hospitals. Bad ventilation has consequently been put down as one of its causes, the others being cold, exposure, internal irritation, and the division of the umbilical cord.

Predisposing Causes of Tetanus.—Dismissing the last form of the disease from our consideration, it seems that tetanus may be found at any period of life, but more than half of the cases occur between ten and thirty years of age. The youngest case on record was in a child of twenty-two months, the oldest in an adult of seventy-five years.

It is more common in males than females in the proportion of seven to one. It is found in the healthy as frequently as in the cachectic, and there is no evidence to indicate that the intemperate are more prone to its attack than the temperate. It is as frequent in the winter as in the summer months; but in warm climates the natives are more susceptible to its attacks than are Europeans. Exposure to damp or cold, and sudden changes of temperature have doubtless a powerful influence in exciting this disease, both in the idiopathic and traumatic forms—Larrey stating that after a great battle one hundred soldiers were found in one morning affected by it.

Exciting Causes.—Tetanus may follow every form of injury, the slightest contusion or the severest compound fracture. It may occur after the extraction of a tooth, or after the gravest operation in surgery. As an incident in obstetric practice it is also known as *puerperal* tetanus. It is, however, rare in the course of ordinary surgical disease. It is most common after the more severe varieties of injury and accident, such as burns, compound fractures, and injuries to the fingers and toes. There is no evidence to prove that it is more frequent after slight injuries to the fingers

and toes than after injuries to other parts. Seven years' experience at Guy's Hospital gives the following facts (Poland):

Tetanus occurred in	1 case	out of	1394 cases	of major and minor operations.
"	"	9 cases	" 594	" of wounds of all varieties.
"	"	1 case	" 856	" of injuries and contusions.
"	"	3 cases	" 456	" of burns and scalds.
"	"	9 cases	" 398	" of compound fractures.
		23	3698	" or 1 in every 160 cases.

Lacerated wounds, however, seem to be more frequently followed by tetanus than incised ones, particularly in children. The state of the wound does not appear to have any influence on the disease.

There is no definite period at which tetanic symptoms are prone to appear. When they set in soon after the injury, they are, for the most part, acute and very fatal; when three weeks have elapsed, the chances of their appearance are very small. The later the symptoms set in, the more favorable are the prospects of recovery, although acute cases occasionally occur during the second week. Poland gives us the following facts:

Of 277 cases,	130	began	before the 10th day,	and of these 101 died.
"	"	126	" between the 10th and 22d day,	and of these 65 died.
"	"	21	" after the 22d day,	and of these 8 died.

In idiopathic tetanus the symptoms generally appear rapidly after the exciting cause, a few hours after exposure to cold being often sufficient. With the same exciting cause, however, like results occur in the traumatic form.

Symptoms.—There are no premonitory symptoms of this affection, either general or local, by which the onset can be recognized. The earliest indications of its approach are generally a difficulty in opening the mouth, with stiffness in the muscles of the lower jaw; but these symptoms may be so slight as to pass unheeded, or be misinterpreted; when, however, some rigidity of the muscles of the neck, throat, or abdomen can be made out, and the first indications of the "tetanic grin," or *risus sardonius*, recognized—this symptom being caused by the drawing down of the corners of the mouth, by the muscles of the face—the diagnosis becomes more sure. Difficulty in swallowing will soon appear, and any attempt to drink fluids may excite spasm of the muscles of deglutition, and often of respiration. Pain, at this time, shooting through the body, from the scrobiculus cordis, will indicate spasm of the diaphragm.

The muscular system generally of the body will now be more or less affected, and in different cases different groups of muscles will be involved. Those of the back are the most frequently attacked, and the contractions of these may be so powerful as to cause an arching backwards of the frame, causing what is known as *opisthotonos*. In rare cases the body is bent laterally or forwards, the terms *pleurosthotonos* and *emprosthotonos* being respectively applied to these conditions.

The muscles of respiration are, as a rule, affected early in acute cases, and the chief danger to life rests in the severity of the spasms which attack them. When severe, the first spasm may be the last, and this may occur at an early period of the affection, or at a remote one. Spasm is the chief immediate cause of death in this disease. I had a case under my care, not long since, of severe traumatic tetanus, in which all the symptoms were disappearing, and recovery was confidently looked for; but on the tenth day of the disease, the first spasm of the laryngeal muscles took place, and destroyed life.

When the jaw is unlocked by a spasm of the depressor muscles, the tongue is at times suddenly shot out from between the teeth, and often wounded.

As the disease advances the jaws become completely fixed, and deglutition becomes impossible. The spasms of the muscles of the frame become more intense and frequent, and the powers of the patient consequently rapidly decline. The pulse, which has been rapid, becomes more feeble, while the expression of the countenance betokens the agony of the body, and despair of the mind. The slightest manipulation or movement of the patient sets up fresh spasm, and any mental emotion may do the same. The skin becomes bathed with a cold sweat, and if death is not caused by suffocation, exhaustion soon puts an end to suffering.

There is rarely any fever during the whole course of the disease. The bowels are always costive, the stools offensive, and the urine as a rule natural.

The intellectual faculties of the patient almost always remain unimpaired throughout, and the senses are morbidly acute. Epilepsy, delirium, and coma are rarely present, and in exceptional instances the muscular spasms begin in the seat of injury.

Should the case tend towards a recovery, the spasms will become milder in character, and occur at longer intervals till they disappear; but *it must be remembered that, as long as the slightest evidence of disease exists, a sudden spasm of the glottis may at any time destroy life.*

Diagnosis.—This ought not to be a difficult task, and in every instance of lockjaw the possibility of its being the commencement of tetanus ought to be entertained. Local irritations, such as have been previously alluded to, should be looked for; but all these causes only produce a locking of the jaw more or less complete, they are never accompanied by uncontrollable spasm, as is the case in tetanus.

To diagnose between tetanus and poisoning by strychnine may be somewhat difficult, the symptoms of both being very similar. Yet in tetanus the symptoms are progressive, while in poisoning they appear suddenly in all their severity. In tetanus the symptoms are always present, and are aggravated at intervals; in poisoning there are complete intervals of relaxation of muscle. In tetanus there is constant rigidity of the muscles of the jaw; in poisoning the jaw is never locked except during the spasm. These points of difference are enough to help the surgeon in the investigation of a doubtful case.

Again, hydrophobia and tetanus have been mistaken the one for the other, but any one who has seen the former disease could hardly fall into the error. The peculiar restlessness of mind and body in hydrophobia, the complete intervals of rest and absence of spasm, the peculiar aversion that is shown to fluid, accompanied with thirst, are enough to distinguish between the two. Nevertheless, it should be remembered that Dr. Ogle, of St. George's, has recorded a case of tetanus and hydrophobia combined. ("Brit. and Foreign Med. Rev.," 1868.)

Prognosis.—In acute traumatic cases there are small hopes of recovery taking place. In chronic cases the chances are more favorable. The longer the patient lives the better are the prospects of a good result; and if ten days pass after the first appearance of the symptoms, and the disease is on the decline, the prognosis is favorable.

Taking all cases together, Poland gives one recovery to seven and a half deaths. More than half the cases die within five days. The most rapid death has been in from four to five hours; and the longest duration of life on record, in a fatal case, is thirty-nine days. But as long as any symp-

toms exist there is danger, for a fatal spasm of the larynx may destroy life at any time.

How Death is Caused.—There can be little doubt that tetanus commonly destroys life by apnœa, spasm of the muscles of respiration, and more particularly of the laryngeal muscles, being the immediate cause. Poland tells us that of forty-six cases in Guy's Hospital in which the mode of death was noticed, in thirty-two it arose from this cause. When death does not take place from the above cause, it is usually due to exhaustion. In rare instances it may be produced by spasm of the heart.

In acute tetanus death is caused by apnœa, in the chronic form it results from exhaustion. These facts have an important bearing on the treatment of the disease.

Pathology.—The late Mr. Wilkinson King, of Guy's, is stated by Poland to have been in the habit of remarking at the post-mortem table, whenever there was an examination of a case of death from tetanus, "Gentlemen, we will now proceed to give you a demonstration of a case of healthy anatomy, for there will be no visible morbid appearances otherwise than congestion of the organs in various degrees, which are owing to accidental circumstances." And at the present time these remarks hold good. It is true that Rokitsansky, Demme, Lockhart Clarke, and Dickinson, have given us some descriptions of structural changes in the spinal cord which they have observed; and these observations moreover appear to coincide. "These changes seem to consist of disintegration and softening of a portion of the gray substance of the cord, which appears in certain parts to be in a state of solution. The fluid thus formed, however, is at first more or less granular, holding in suspension the fragments and particles of the disintegrated tissue, but in many places it is perfectly pellucid." (L. Clarke.) Yet it is to be remembered, that Billroth and other pathologists have failed to find these changes in the instances they have examined, and it cannot therefore be accepted as certain that these pathological conditions are constant in tetanus. There can be little doubt, however, that the nerves of the injured part are at times found inflamed and irritated, and from this fact the theory has been advanced, that through the injured nerves of the part the spinal centres become involved, and manifest these states of excitement through the motor nerves by producing muscular spasm; the disease being one essentially of the excito-motory system. Clarke believes the lesions described depend on the conjoint operation of injury of the peripheral nerves, accompanied as it is by hyperæmia and a morbid state of the bloodvessels of the cord, with its resulting exudations and disintegrations.

TREATMENT.—Every imaginable form of treatment has been employed in this disease with success, to be discarded in its turn for something new. No settled form of practice can consequently be given to guide the student. Still much can be done in this disease in guiding it through its course; in keeping the patient alive; in warding off death.

To keep the patient alive, feeding is an essential point; milk and concentrated liquid animal food being the best. If they can be taken by the mouth in sufficient quantities, no other mode of administration is required; but if not, they must be given as enemata by the bowel, every four or six hours as the case demands. Stimulants must be used cautiously, but when the powers are failing they may be freely given.

Upon this principle of practice, that some cases have done well under it, quinine has been strongly recommended; and it is without doubt a valuable remedy. It may be given in full doses in an adult, such as five grains

every three or four hours, and increased; or one large dose may be given at first, such as twenty grains, to be followed up by the smaller one.

Among specific remedies that have a direct influence in checking muscular spasm, the Calabar bean has been greatly vaunted; and camphor in large doses—having the same action—recommends itself to our notice. The former drug may be given in one-grain doses every two or three hours, and the latter in doses of from five to ten grains. The woorara poison has failed in its purpose. The bromide of ammonium promises well.

It was hoped that a valuable drug for this disease had been found in chloroform, but experience has not justified expectation; and now the hydrate of chloral takes its place and promises to be of some service. Demme has advocated with much success the use of the Curara, eight cases out of twenty-two having recovered under this treatment; and in India the Indian hemp has been highly recommended. Nicotine and tobacco have also been successful. Aconite is another drug that offers some advantages, and opium has an unquestionable influence in allaying pain and mitigating the severity of the spasm. Ice also, applied in bags along the spine, has apparently been of great value in the hands of American surgeons. The administration of remedies by subcutaneous injection promises to be a valuable adjunct to practice in these cases, enabling us to introduce rapidly into the system drugs that act antagonistically to tetanic spasm.

The patient should always be kept quiet, warm, and free from draughts. He should be so tended that in his spasms no injury can be sustained, and attention paid to his bladder and bowels, for catheterism is sometimes called for, and purgatives or enemata to clear out the intestine are always of use. Violent purgation, however, cannot be advised.

With respect to *local treatment* much may sometimes be done, for in severe local injury, when the nerves of the part are probably involved, amputation ought certainly to be performed. A sufficient number of cases have been recorded in which success has followed the practice; and as it offers a reasonable hope, where none otherwise exists, it ought not to be neglected. In 1845 Mr. Key amputated a leg on account of tetanus, which had appeared six days after an unreduced dislocation of the astragalus. The symptoms disappeared at once after the operation. On dissecting the foot the posterior tibial nerve was found to have been put violently on the stretch by the projecting astragalus.

In some cases soothing applications, such as opium, may be applied to the wound, and in all perfect cleanliness should be enforced.

One other means of cure remains to be noticed, and it has reference to the mode of death in this disease. It has been shown that in the larger proportion of cases—in all the acute—death is caused by suffocation, by spasm of the laryngeal muscles. It is also fairly recognized that this disease will run its course, and that the most our science can do is to maintain life and ward off death. To this end the operation of tracheotomy seems to promise to be of value, for with a tube in the trachea, death by laryngeal spasm cannot take place, and a better prospect of recovery is consequently given.

I have employed this practice in one acute case in which the Calabar bean was likewise given, and the patient sank from exhaustion, free from spasm; and there seems good reason to believe that if I had performed the operation in the case I recorded in the early part of this chapter, life would have been saved. This question, however, requires grave consideration, and the practice is not to be rashly adopted.

Morgan, "On Tetanus," 1833.—*Curling*, "On Tetanus"—*Poland*, "Guy's Hospital Reports," 1857.—*Dr. Ogle*, "Brit. and For. Med. Review," 1868.—*Dr. Dick-*

son, "Med.-Chir. Trans.," vol. vii.—*Dr. L. Clarke*, *Ibid.*, vol. xlviii.—*Dr. Dickinson*, *Ibid.*, vol. li.—*Demme*, "Schmidt's Jahrb.," vol. 112.—*Thomhayn*, O., *Ibid.*—"Year-Book," Sydenham Society, 1862-64, &c.—"Puerperal Tetanus," "Dublin Quart. Jour.," 1865; "Med. Times and Gaz.," 1865.—*Billroth*, "Pathol. Chirurg.," 1868.

CHAPTER IV.

DELIRIUM TREMENS.

THIS formidable affection is far from being rare in the practice of surgery. It is found in subjects who have habitually over-stimulated their nervous system by intoxicating liquors, and have been subjected to some great or sudden depressing influence. It is consequently often met with after a severe local injury, or in the course of a diffused and exhaustive suppuration. It is found in persons of intemperate habits, who have been depressed by starvation or mental anxiety; and it is said to be caused by the habitual overuse of tobacco or opium. It may be produced, however, in any nervous system that has been for a period over-stimulated and then suddenly subjected to a depressing influence, mental or physical.

The disease is at times ushered in by certain premonitory symptoms; for patients who have once been the subject of an attack are sometimes conscious of the approach of another. A brewer who had been treated for this affection at Guy's some years ago, on several occasions subsequently applied for admission, when he felt warnings of its advance, and as a result the attack was warded off.

Depression of mind and of body are probably the chief premonitory symptoms, with restlessness and agitation, gloom and foreboding of evil. Some slight febrile disturbance may exist, and sleeplessness is commonly present. The tongue is generally pale and flabby, and when coated, covered with a whitish fur: it is never dry. The appetite is bad, the breath is often fetid, and the bowels are confined. The pulse may be quick, but it is soft and powerless. The skin is always moist, and at times bathed in perspiration. With these symptoms the characteristic delirium with trembling is not far off. It may, however, in surgical practice set in suddenly without warning. The nature of the delirium is very characteristic; it is always accompanied by illusions, and these are generally spectral. The patient sees things that do not exist, and hears sounds that have no reality; these are generally also of a strange or frightful nature. At times some delusion about business or home matters agitates the mind. The same ideas are sometimes fixed during the whole attack; but more commonly various ideas succeed one another in rapid rotation. Sleeplessness under these circumstances is a constant result. The patient will for a time be quiet, muttering words without meaning, or he will be restless and get out of bed in obedience to some imaginary call. He will pull his bedclothes about. He will be up in bed at one moment under one impression, and will lie down again under another. If asked to put out his tongue, he will do so, but probably with a jerk; if to give his hand, he will project it with a thrust. A nervous trembling of the extremities will readily be recognized, and an utter want of control and steadiness of purpose is characteristic. If these symptoms continue, and rest cannot be obtained, prostration of all the powers will rapidly appear, and death either by exhaustion or

coma. If sleep—sound sleep—can be secured, the disease may vanish as a dream.

TREATMENT.—This disease being essentially one of depression of the nervous system, associated with sleeplessness, the main object of the surgeon is to procure sleep by means of narcotics, to calm the excited brain, and give it time to recover its normal functions; at the same time giving bland and nutritious food to keep up the powers.

Opium, in some of its preparations, is consequently the drug chiefly in favor. In an ordinary case of the disease, one grain may be given as a dose, or ℥xx of the tincture, and repeated every three or four hours or oftener, till sleep is procured. In other cases two or three grains may be given at once, and followed up by grain or half-grain doses. In others, again, the subcutaneous injection of morphia may be employed in quarter or half-grain doses in solution, and repeated if necessary; and it is this mode of administering narcotics that I would recommend; for the condition of the stomach of patients suffering from the disease is far from satisfactory either for absorption or assimilation, and by the hypodermic method of introducing the narcotic into the system, its absorption is more certain and more rapid. In some cases the beneficial influence of morphia thus employed is most remarkable, and it is only in exceptional instances that the treatment fails.

Where great excitement exists, chloroform may be administered, and during the calm of its influence morphia may be given by the hypodermic method; the action of the narcotic maintaining the influence of the chloroform, and thus producing sleep.

The practitioner must remember, however, that any dose of a narcotic beyond what is required to procure sleep is injurious; adding to the depression of the powers of the patient, and consequently bringing another element of danger.

The hydrate of chloral promises to be a drug of great value, given in twenty- or thirty-grain doses, and repeated every half hour for three or four doses, till sleep is procured. It seems to be a very powerful hypnotic, without having the evil influence of other drugs upon the secretions.

Drs. Kinnear and Lawson in the Melville Hospital have treated from seventy to eighty cases successfully with large doses of cayenne pepper, from twenty to eighty grains having been given at a dose. And Dr. Maclean, of Netley, trusts to quiet, and the use at short intervals of strong beef tea highly charged with cayenne pepper.

Easily digested, nutritious food must be administered, when it can be taken, by the mouth; when refused or rejected, by the bowel. Milk is undoubtedly the most suitable form when it can be borne, either alone or mixed with eggs or stimulants in the alcoholic form. Strong animal broths are always of service. Stimulants must be given in most cases, although with caution; and that form is the best to which the patient has been accustomed. When this disease is met with after severe local injuries, and the powers of the patient are much depressed, there is no limit to the amount of stimulant that may be required. It should be measured only by the wants of the patient, and by its effects upon his powers. When beer in one of its forms is the only drink the patient will take, it may be mixed with egg; or, what is better, Liebig's extract of meat, or Darby's fluid meat may be dissolved in it, without the patient being able to detect its presence.

Of late years, the value of digitalis has been greatly extolled, but my experience of this drug has not been favorable. It is given in large if not poisonous doses; two drachms of the tincture every hour for three or four

doses, till sleep is produced. It is a dangerous plan of treatment, and cannot be recommended.

When great excitement and some fever exist, antimony in small doses has been much advocated, and under these exceptional circumstances it may be employed. Drs. Laycock, Pirrie, and others reject the use of opium altogether, and trust to feeding and time, relying upon the knowledge that the disease has a natural tendency to terminate in sleep after the second or third day. The condition of the bowels almost always demands attention, for the tongue is usually foul and the secretions are morbid. A purge sufficient to empty the colon is consequently of service, but violent purgation is injurious.

Tonics, as quinine and iron, with or without opium, will be required as the disease subsides. The combination of the tincture of iron with the tincture of opium in carefully regulated doses is to be preferred; in other cases ammonia with bark may be administered.

With respect to coercive measures in the treatment of these cases, there is no doubt that they are to be condemned. In exceptional instances, where sufficient help cannot be obtained to prevent the patient from injuring himself or others, the jacket doubtless must be employed, but under no other circumstances is it justifiable. An attendant who combines decision of character and firmness, with a gentle and soothing manner, will almost always succeed in "influencing" the most troublesome patient. He is to *influence* him, however, and not to direct him; for contradiction and the exercise of authority over such subjects of disease always excite opposition.

There is a class of subjects who never get drunk, yet are always drinking; in whom the tissues are so weak that under injury they rapidly break up; and under disease they show no evidence of repair. Treatment of these is always a source of great difficulty, for it is always attended with little hope. In such, nutritious food with stimulants enough to keep the machinery of digestion going are most essential, but excess of stimulants is injurious.

SURGERY OF THE NERVOUS SYSTEM.

INJURIES OF THE HEAD.

CHAPTER V.

CONTUSIONS AND WOUNDS OF THE SCALP.—BLOOD TUMORS.—OSTITIS.

INJURIES of the head are always of importance, and a blow upon the head is never to be treated lightly; for although it may not be followed at the time by any symptoms of brain disturbance, and the only apparent result be a simple bruise, the bone may have suffered with the integument, and, as a consequence, grave results may ensue; for an acute inflammation of the diploë of the skull is a condition fraught with danger, and a chronic inflammation of the bone is scarcely less serious.

When evidence exists of brain disturbance as a primary effect of injury,

the importance of the case is increased, for the severest effects may follow the simplest accident. It is well for the student to have these truths impressed on his mind at the beginning of a chapter on injuries to the skull, for they have a practical bearing of vast importance.

Contusions of the Scalp, and Blood Tumors.—The integuments of the scalp have this peculiarity, that they are intimately connected with the aponeurosis of the occipito-frontalis muscle; indeed, practically, these parts may be regarded as one, for they are not to be separated, and they move together over the cranium. They are well supplied with vessels, and, consequently, have good power of repair, and rarely slough. A *simple contusion* of the scalp, uncomplicated with any great effusion of blood or other local injury, requires little surgical attention. It has a tendency to recover like contusions of other parts; but when complicated with effusion of blood to any extent, difficulties arise. This complication (blood effusion) is best seen in newly born children, as a result of a difficult or instrumental labor, although at times it appears where no such cause can be assigned. It is usually situated over the parietal bone, showing itself as a more or less circumscribed, soft, fluctuating tumor; but the largest I have ever seen was over the occipital. At times this tumor may have an indurated base, raised from, and apparently continuous with, the bone, with a defined edge towards the centre, giving rise to the idea that a fracture with depression exists. When the tumor is small and confined to one bone, it is probable that the blood is effused beneath the pericranium. This affection is generally known by the term *cephalhæmatoma*. In the more diffused form, where the swelling covers in more than one bone, the effusion, doubtless, is poured out beneath the aponeurosis of the scalp and the pericranium.

In the *subpericranial form* the indurated base may organize, or inflammatory matter may be poured out around it, which assumes the character of bone, more or less covering in the swelling. In other neglected cases suppuration, which occasionally passes on to involve the bone itself, may follow.

In the *subaponeurotic form* the blood is generally rapidly absorbed. In feeble infants this process may be delayed, or may fail to be accomplished; under which circumstances surgical aid is called for.

Later in life, contusions of the scalp may be followed by precisely similar results; and blood may likewise be effused into the skin itself; when it appears as a hard, unyielding lump. In the subaponeurotic effusion the tumor may be very large, even covering the head, when to the hand a peculiar crackling sensation will be often given, which is very characteristic. When an indurated base exists—giving rise to the suspicion of fracture—the diagnosis will be assisted by the surgeon firmly pressing his thumb or finger upon the ridge for a few seconds: this act in a recent case often displacing the fibrin, revealing the uninterrupted continuity of the bony surface, and thus proving the nature of the case. There will also be an absence of symptoms of fracture. When the case is complicated with brain symptoms or a ruptured artery, giving rise to pulsation in the tumor, some difficulty in diagnosis may be experienced.

TREATMENT.—In an ordinary case of contusion or blood-tumor the application of a cold or spirit lotion is usually sufficient, the muriate of ammonia, in solution, being as good as any. When the tumor has formed very rapidly—indicating a severe laceration of the vessels—and feels tense or pulsating, powdered ice in a bag should be applied, the cold preventing the flow of blood and encouraging absorption. Should evidence exist of rupture of a large artery, such as the temporal or occipital, as indicated by pulsation of the tumor and other symptoms, it may be advisable to apply

pressure over the trunk of the vessel. When absorption of the effused blood does not take place, the cystic swelling should be tapped, the fluid drawn off, and pressure applied; and this operation may be repeated several times, the fluid often becoming serous. Should it fail, a moderate incision is required, sufficient to allow of free escape of the pent-up fluid, and to prevent its re-collection; gentle pressure being subsequently made on the part. In very obstinate cases the tumor may be treated as a serous cyst, and injected with iodine. When the effused blood breaks up, and causes suppuration—a somewhat rare result—a free incision will be required, and the case should be treated as one of abscess. During this period tonic treatment is often called for to improve the patient's powers. When the tumor is large the patient must be kept quiet, and free from excitement, the diet being carefully regulated according to the special wants of the case. As a rule all these cases do well.

Scalp Wounds.—Incised and lacerated wounds of the scalp are very common, and when uncomplicated with injury to the skull or its contents, generally do well. Large portions of the scalp may be torn away from its connections with the pericranium or bone, much bruised and injured, and yet when readjusted the patient may perfectly recover without a bad symptom; the extreme vascularity of the scalp favoring the repair. It is generally thought that these wounds are especially "liable to prove the exciting cause of erysipelas." I am disposed to doubt the accuracy of this assertion, for from my notes of 175 cases of scalp wounds admitted into Guy's in eight years—and it must be added that only the severe ones are admitted—erysipelas followed only in three. Lacerated or contused wounds of the scalp rarely slough, and should be treated as the incised.

Punctured wounds are liable to be followed by diffused inflammation beneath the scalp.

TREATMENT.—Under all circumstances and conditions scalp wounds should be carefully cleaned with tepid water—the utmost gentleness being used—their edges may then be adjusted and maintained in position. When the wound is not extensive, and can be adjusted by strips of plaster, sutures are not needed; but when any difficulty is experienced, they may be as fearlessly applied as they are to other parts; indeed in extensive lacerations of the scalp, the application of sutures is far preferable to any other form of practice, for the wound can be kept clean and moist by water-dressing, which is not possible where a quantity of strapping has been employed. The hair must be cut off in the neighborhood of the wound, and the head kept cool. One caution, however, must be observed in the application of the suture, and that is, not to include the aponeurosis of the occipito-frontalis muscle, for there is more danger of setting up mischief in the cellular tissue beneath this tendon when this practice is adopted than when the sutures simply pass through the skin itself. The kind of suture is unimportant, although many surgeons prefer the metallic. All sutures should be removed on the second day, as wounds of the scalp heal rapidly.

When the bone is exposed and the pericranium torn off the same practice is to be adopted, for there is every prospect of as satisfactory a recovery taking place as usually occurs in a less complicated case. When the bone has been much injured, however, superficial necrosis occasionally follows. Should diffused suppuration occur in the cellular tissue beneath the aponeurosis, the sooner a free escape is given to the matter the better, for such cases are always attended with great danger to the periosteum, the bone, and even the life of the patient. The edges of the wound should be separated in parts, to attain this end, or *limited* incisions made through the tissues to the bone, for as long as a free vent for discharge is made, more is not

needed. By doing this early, the extension of the inflammation will often be checked, and the extent of sloughing of the cellular tissue limited.

When extensive sloughing takes place, there is no reason why a good recovery should not follow, if the powers of the patient are good and the kidneys sound. Warm fomentations and water-dressings should always be applied.

The powers of the patient must be kept up by tonic medicine—iron or quinine—generous diet allowed, and stimulants when needed. Sedatives to procure sleep are also essential.

When bleeding is troublesome, the arteries should be twisted or ligatured; when it exists as a general oozing of blood, pressure may be applied either to the wound or to the trunks of the supplying vessels. In rare cases where the deep vessels of the temporal fossa are wounded, and bleeding cannot be arrested, the question of applying a ligature to the external or common carotid may have to be entertained; it has never fallen to my lot, however, to witness such a case.

Contusion of the Bones of the Skull.—This is, doubtless, a common associate of injuries of the scalp, both with or without a wound; and scratching or abrasion of the bones is frequently combined with a laceration of the scalp. In the majority of cases such as these a good recovery follows either accident, and it is only in exceptional examples that a different result takes place; acute inflammation of the bone with all its dangers, or a chronic inflammation with all its difficulties, may, however, follow a simple bruise.

Acute inflammation of the bone is a severe affection, more particularly when the diploë is involved; for the diseased action is disposed to extend inwards to the dura mater, to the arachnoid, or even to the brain, giving rise either to a diffused inflammation of any or all of the parts, or to a local suppuration either between the bone and the dura mater, in the cavity of the arachnoid, or in the pia mater or brain structure. A thickening of the injured bone may, moreover, ensue, or a necrosis more or less general, or what is called pyæmia may take place.

A *chronic inflammation of the bone* may be followed by very similar results.

The symptoms which indicate either of these two conditions generally appear two or three weeks after the accident, and vary in intensity according to the action. In acute disease there is more constitutional disturbance and headache, passing on to general brain disturbance, convulsions, paralysis, coma and death. In chronic disease the general symptoms are less severe, and the local milder, but persistent headache is always present. When the inflammation spreads inwards towards the arachnoid and brain, other symptoms show themselves; severe local pains passing on to delirium, twitching of the muscles, convulsions, paralysis, coma, and death; the rapidity of the progress of the disease governing the symptoms. When rigors appear suppuration is indicated, often of the pyæmic form: and convulsions of an epileptic nature are frequently found in the chronic form of the disease.

Persistent headache after an injury to the head is always a symptom demanding anxious attention, for it too often means progressive mischief within the skull. The condition of the wound is no guide. In the chapter on intracranial inflammation this subject will receive further elucidation.

CHAPTER VI.

INJURIES OF THE CRANIUM.

THERE are some leading practical facts or principles that should be impressed upon the memory of every surgeon who has to deal with head injuries; and these I have compressed into the following forms, believing it to be well to place them at the beginning of a chapter on injuries to the skull.

1. Fractures or injuries of the skull are of importance so far as they are associated with injury of the skull contents; a compound fracture uncomplicated with shaking of, or injury to, the cranial contents, being less liable to be followed by bad results than a simple fracture associated with brain mischief.

2. The amount of injury to the brain cannot be estimated by the severity of the primary symptoms; a severe injury to the brain being frequently associated with slight symptoms, and a slight injury with severe symptoms.

3. The character of the accident and the mode of its production are the best guides in estimating the nature and severity of the injury, and its probable results; a fall from a height upon the head, or a blow from a heavy weight causing a general injury of the brain; and a fall upon or a blow from a sharp instrument a limited one.

4. A general shaking (concussion) of the brain, whether associated or not with fracture, simple or compound, may give rise either to temporary suspension of brain functions, ending in recovery; to laceration of the membranes; or to a more or less severe bruising of the cortical structure of the brain, or laceration of its substance; the amount of hemorrhage complicating the case depending upon the size, number, and healthiness of the vessels that are ruptured. Thus a general shaking or concussion in a healthy brain may produce a temporary suspension of cerebral functions only, when the same injury in an unhealthy or aged one, in which diseased vessels ramify, may be followed by a fatal hemorrhage or apoplexy.

5. Under certain conditions of the system, a slight concussion will be followed by a fatal secondary inflammation of the brain-coverings, and under other conditions a severe injury to the brain will be followed by no such result, the former termination being commonly found when the kidneys are diseased.

With these general propositions as a guide, which the student should learn and think over, I will now proceed to consider the subject of fractures of the skull.

FRACTURES OF THE SKULL.

They may be divided into fractures of the *vault* and fractures of the *base*, a third and large division including those of the *vault and base*. They may likewise be *simple* or *compound*, *comminuted*, *depressed*, or *undepressed*.

Fractures of the vault are generally caused by direct blows upon the part, or falls upon sharp bodies. They include most of the *punctured* fractures and *incised* wounds of the bone, as in sword wounds, &c. They are very frequently compound and comminuted, and when brain injury is associated with fracture of the vault alone, it is for the most part local.

Fractures of the base of the skull, or of the vault and base combined, unless produced by a crushing of the head, are mostly caused by a fall

from a height upon the head, or blow from a heavy falling body. Brain injury is for the most part of a general nature and severe; a violent shaking of the brain being, as a rule, followed by serious injury, the amount depending much upon the force of the concussion.

Fracture of the vault may appear as a simple fissure, the extent of which is determined by the force employed and its character, the line of fracture being influenced by the sutures and ridges of bone.

When the force is local and moderate the fracture may be limited; when concentrated and severe the fracture will be "starred" and generally "comminuted," the fissures radiating in all directions, involving many bones, and passing downwards towards the base. When inflicted with a blunt-edged instrument, the fracture will be depressed in a gutter shape (Fig. 3); when with a round one, as a hammer, the bone will be smashed in more like a "saucer" (Fig. 4). When the fracture has been caused by a fall from a height upon the vertex, or by a blow from a heavy body, the bones of the vault and the base may not only be fissured, but displaced; the sutures even may be dislocated.

Comminuted fractures are generally the result of a concentrated local violence, and are consequently chiefly found in the vault, and are mostly compound (Fig. 5).

In some cases of fracture of the vault, the bone will be depressed or driven in upon the cranial contents; in rare instances it will be elevated, ploughed up, or displaced outwards; in sabre wounds this result is common.

In some the fracture will be confined to the outer table of the skull, in rare instances to the inner; a fracture, with depression of the inner table, occasionally existing without any fracture of the outer. In Guy's Museum there is a specimen of fractured skull, in which the outer and inner tables are both fractured, but not in corresponding parts.

The direction of the fracturing force has much to do with the form of fracture. When the blow is from without, and sufficient to involve the whole thickness of the bone, the inner table, as a rule, will be fractured to a greater extent than the outer. When the force acts from within the reverse holds good. This latter fact is best seen in gunshot fractures; and in Guy's Museum, Prep. 1082⁷⁰, the point is admirably illustrated. It was taken from a patient of Mr. Poland's. The external table is starred, but no fracture of the internal exists; the injury to the bone having been produced by a bullet which had passed through the opposite side of the skull and struck the inner table.

As points of practice, however, it is well to bear in mind that, in all ordinary cases of fracture with depression of the bones of the skull, the injury to the inner table is far greater than that of the outer, and the point of exit of any foreign body through the skull is always larger than that of entrance.

FIG. 3.

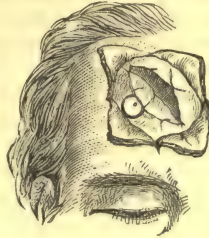


FIG. 4.

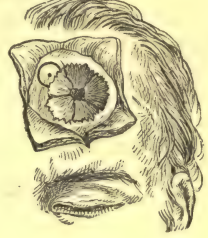
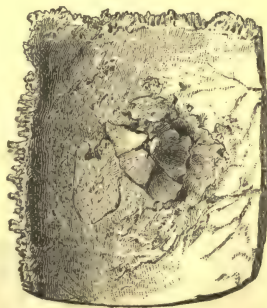


FIG. 5.



Comminuted fracture of skull with depression of inner table from direct local violence. (Prep. Guy's Mus.)

Whether depression of the bones of the skull of an adult ever occurs without a fracture is an open question. There is certainly no good evidence in support of the fact. In children it has happened without giving rise to any symptoms of brain compression; but even here, says Mr. Hewett "some of the bony fibres must have given way." In these cases the depressed bone subsequently rises up again to its natural level.

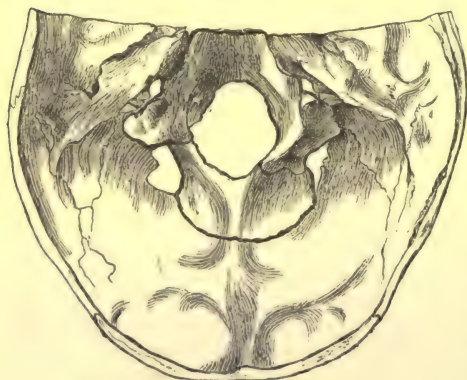
The practical interest, however, that is attached to all these varieties of fracture is concentrated in the question as to how far the cranial contents are involved in the injury. Has the brain been slightly concussed, or so shaken as to have been bruised or lacerated? Have the membranes of the brain been torn, lacerated or injured? Is the fractured bone a source of irritation to the dura mater? A compound fracture with or without depression, uncomplicated with brain disturbance or brain injury, is a cause of far less anxiety than a simple fracture in which severe brain concussion has taken place, and is indicated by symptoms; a severe shaking of the brain, whether complicated or not with a fracture, being a far more serious accident than any local injury to the skull.

Fractures of the Base of the Skull, or Vault and Base combined—for these conditions ought to be considered together—are invariably severe injuries. They are generally caused by a diffused force, such as that produced by a fall from a height upon the vertex, or a heavy blow. "When the former, the plunge of the body is suddenly arrested by the vertex coming in contact with the ground, and the entire superincumbent weight, with the superadded momentum acquired by the velocity of the fall, is concentrated around the condyles of the occipital bone, and the central compartment of the base of the skull is thus broken across." The fracture is the result of direct violence, and not of so-called *contre-coup*.

"Thus, if the injury be inflicted by the fall of a *hard* and heavy body on the vertex, this part would be fractured; and if the weight were not very great, the mischief might end there, as the resistance offered by the head may so far exhaust the momentum of the falling body that the force would not be transmitted in sufficient amount to cause fracture of the base. But if the weight and momentum of the falling body were in excess of the expenditure of force in causing fracture of the vertex, the impulse would

drive the head down upon the summit of the spinal column, and fracture of the base would result; in that case, viewed mechanically, the lower fracture would be successive to the upper. But if the falling weight which struck the vertex were of a yielding material, fracture, if any, would be in the base, and not of the vertex, because the *vis inertia* of the skull would be overcome, and it would be driven down upon the spine, without the application of circumscribed force to the vault. The same reasoning applies when frac-

FIG. 6.



Fracture of bone from fall on vertex.

ture of either the vault or base, or of both together, is the effect of a fall on the vertex; or this result may be varied by the blow being received on

the forehead or occiput; the anterior or posterior divisions being thin, and severally more obnoxious to fracture." (F. Le Gros Clark.)

Injuries to the occiput are commonly followed by longitudinal fracture of the base, involving both the posterior and middle fossæ.

Injuries to the temporal region or about the ear are followed by fracture of the petrous bone and the middle fossa; they are always serious.

But, in diffused injuries to the head, it is rare to find one fossa alone involved, fissures generally passing through two fossæ, extending from the vault or part struck.

The evidence afforded by my notes of two hundred cases of fatal head injuries bring out these points very strongly.

These facts have also been experimentally proved by Dr. Aran.

"In precipitating a large number of bodies from various heights on to the head, Dr. Aran found that the part of the vault which first struck the ground gave, as it were, the key to the fracture which would take place at the base. Similar results were also obtained when diffused blows were dealt upon different parts of the skull by means of a large and heavy hammer. In the front part of the vault injuries thus produced led to a fracture of the anterior fossa; in the middle part of the vault they led to a fracture of the middle fossa; and at the back of the head to a fracture of the posterior fossa. In no single instance was a fracture detected at the base without a line of fracture in the corresponding part of the vault. The truth of this has been proved by an analysis which I made of all the cases of fractured base of the skull admitted into St. George's Hospital during a period of ten years." (Prescott Hewett.)

My own observations have gone entirely to prove the correctness of these views. The middle fossa is the one, however, most frequently involved.

Compound Fractures of the Skull are, as a rule, local fractures. They are generally the result of a concentrated blow upon the part, the force employed having been expended in producing the local injury. They are, consequently, often starred or comminuted fractures and depressed. When the brain is involved in the injury, it is chiefly so beneath the seat of fracture; it is rarely so shaken or concussed as in simple fractures, the result of a diffused blow.

The dangers attending a compound fracture are not, therefore, so much from the direct injury to the brain as from secondary intracranial inflammation, the direct result of irritation of the dura mater from the depressed or comminuted bone; the dura mater being frequently punctured or torn by the depressed bone, and in all cases irritated. These facts have an important bearing on practice, encouraging the surgeon to remove the depressed and irritating portions of bone that have such an injurious influence on the progress of the case. When the brain is injured by the accident, the danger is far greater.

The Diagnosis of Fracture of the Skull.—The best guide to the diagnosis of a fracture of the skull is, without doubt, the nature of the injury. There are no special symptoms by which a fissure of the vault, uncomplicated with a wound, is to be recognized. Upon the post-mortem table extensive fractures of this kind are constantly found, where no suspicion of their presence was entertained during the life of the patient. When a wound complicates the case, a fracture can usually be made out, the broken part appearing as a red line. Care should, however, be taken in these cases not to mistake a suture for a fracture.

When fracture exists with depressed bone the diagnosis is rarely difficult, unless it should so happen that the fracture has taken place beneath the

body of the temporal muscle; under such circumstances it is almost impossible to diagnose its existence by direct signs.

An effusion of blood beneath the pericranium may be mistaken for a fracture with depressed bone, unless care be observed. A natural depression in the skull, particularly in the occipital region, may also be mistaken for depressed bone.

Fracture of the skull, the result of a punctured wound, can, as a rule, be readily recognized, but when the point of the perforating instrument has been broken short off at the surface of the bone, much care is needed.

The diagnosis of a fracture of the base, or of the base and vault combined, is always a source of difficulty, and the nature of the accident is, without doubt, the surgeon's best guide in aiding him in the task; a fall from a height upon the head, or a heavy blow, being the usual cause of such an accident; but a crushing force applied in any direction is a common cause.

Should the fall have been upon the vertex, the middle fossa of the skull will probably be the seat of injury; and should hemorrhage from the ear to any extent have taken place, and this have been followed by the copious discharge of a watery, and perhaps saccharine, slightly albuminous fluid, with paralysis of the parts supplied by the facial nerve, the diagnosis is complete, the fracture having evidently passed through the petrous bone. Hemorrhage from the ear alone is no positive sign. The moderate discharge also of a watery fluid alone is not characteristic, nor is facial paralysis. Profuse and prolonged bleeding from the ear, followed by a watery discharge, is, however, strongly indicative of a fracture; as is also a copious watery discharge directly following the injury; but facial paralysis, combined with either of these symptoms, renders the diagnosis complete.

This watery discharge is now generally admitted to be an escape of cerebro-spinal fluid through a fracture of the petrous bone, passing across the internal auditory canal, and attended with rupture of the membrana tympani.

In injuries to the mastoid process, if a local emphysema exists, the presence of a fracture may be diagnosed.

Should the blow or fall have been upon the anterior part of the skull, the probabilities of the case point to fracture of the anterior fossa; and where any injury can be made out to any of the nerves of the orbit, as indicated by local paralysis of some of the muscles of the eye, or by hemorrhage beneath the conjunctiva, the diagnosis is complete. Hemorrhage into the eyelids by itself is of no value as a diagnostic sign, although when it follows the accident at a later period, and is consecutive to subconjunctival hemorrhage, it is a valuable symptom.

Falls upon the occiput commonly produce longitudinal fissures of the base.

Copious and obstinate bleeding from the nose or pharynx is by no means infrequent in a case of fractured base, and when accompanied with other suspicious symptoms is of a diagnostic value. I have the notes of a case of injury to the head in which the patient apparently died from bleeding from the nose and mouth, no blood coming from the ear; and after death a fracture of the base was found, completely separating the petrous portion of the temporal bone from its connections, and laying open the lateral sinus. The right tympanum was full of blood, but the membrana tympani was entire. The stomach was full of blood, the blood from the lateral sinus having apparently found its way through the Eustachian tube into the pharynx and stomach.

I have also the particulars of a second case, in which the carotid artery was divided in its passage through the petrous bone, and the lateral sinus

laid open, the lungs and bronchial tubes being found filled with blood, even down to the air-cells. Each of these cases lived only two hours after the accident.

A fracture of the base, unassociated with any injury to the brain itself, is of no more consequence than a fracture of another part; but as the base is the most delicate part of the brain, and any injury to it is sure to be followed by severe, if not fatal symptoms, the subject of fracture of the bones upon which it rests becomes proportionally of interest.

A fracture of the base of the skull may be associated with all the intracranial injuries to which fractures of the vault are liable; it may be complicated with simple concussion of the brain, or with the severer form associated with laceration of the brain-structure, or extravasation of blood upon or within the brain itself. If blood is effused there may be compression of the brain and death, and the same end may be produced by a secondary inflammation of the membranes and injured parts.

Upon the whole, it is difficult to separate the two classes of cases, as the dangers arising from injuries to the skull do not depend upon the seat of fracture, but upon the injuries to the cranial contents; and as the same injuries may be produced by, or rather may be associated with, fractures of the base, the complications and dangers are the same in each.

Having, then, so far stated that the dangers of all forms of fracture of the skull are really alike, and that the same intracranial complications attend fractures of the vault as of the base, I will now proceed to illustrate the special symptoms which are generally regarded as being diagnostic of such injuries, by a brief analysis of cases from my notebook.

Amongst thirty examples which are recorded there, twelve cases were associated with simple concussion, and recovery took place in all of these. In three cases the fracture extended through the orbit, as indicated by subconjunctival ecchymosis. In eight examples there was hemorrhage from the ears; in all, this was followed by a discharge of serum, and in seven cases, associated with paralysis of the facial nerve upon the same side. In these cases it is quite fair to conclude that the line of fracture extended through the petrous portion of the temporal bone. In two instances there was bleeding from the nose; in one case there was a serous discharge from the ear, accompanied with paralysis of the facial; in another this discharge followed hemorrhage from the ear, and was unaccompanied by paralysis.

To test the value of these different symptoms, as indicating fracture of the base in various positions, the following analysis of the fatal cases will prove of value; and, taking the symptoms separately, subconjunctival hemorrhage will first claim our attention, as being one which tolerably accurately marks a fracture through the orbital plate. In the eighteen fatal examples, this symptom was manifested in four instances; and in each of these the line of fracture extended through the orbit.

In two cases there was copious hemorrhage from the ear; in both these the fracture passed through the petrous bone.

In three examples there was some epistaxis; in one of these the fracture extended across the ethmoid bone; in one the frontal sinuses were full of blood and fractured; and in the third the tympanum was found full of blood and the membrana tympani perfect, and upon careful examination, the lateral sinus of the brain was found to have been lacerated.

Seven of the eighteen fatal cases died from direct injury to the brain, the post-mortem examination in all revealing severe contusion or laceration of the brain-structure, with effusion of blood upon the surface of the brain or upon the membranes.

Seven other cases died from arachnitis as a result of the injury. In four of these there was contusion of the brain, and in one ecchymosis of the ventricles; in two cases there was no evidence of contused brain, nor was there any effusion of blood; in one interesting case the inflammation spread from the internal ear. In three the cerebral mischief was complicated with some thoracic or abdominal injury, which caused death; and in one instance hemorrhage was the immediate cause of death.

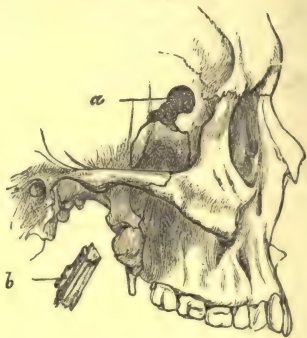
A severe blow upon the nose, by driving in the ethmoid bone, may cause fracture of the base of the skull. (*Vide* Fig. 7.) At St. George's Hospital

FIG. 7.



(Prep. No. 1085⁸⁷, Guy's Hosp. Mus.)

FIG. 8.



a. Punctured wound through frontal bone.

b. Portion of wood which perforated bone.

(Prep. No. 1086⁸⁹, Guy's Hosp. Mus.)

there is a specimen, in which the condyle of the lower jaw, on being forcibly driven against the glenoid fossa, caused a fracture, the condyle of the jaw projecting into the cavity of the skull; and in the Guy's Hospital Museum there is a similar specimen, which was sent in with Mr. Hutchinson's prize essay. Punctured wounds of the orbit are by no means infrequent causes of fracture of the base; many are recorded. I was called to a case, not long ago, in which a lead pencil had perforated the bone and the brain through the orbital plate; and Fig. 8 was taken from a preparation in which the frontal bone was perforated. The diagnosis of these cases is not difficult. When brain-matter escapes externally through the wound there is no room for doubt.

The treatment of fractures of the skull will be described after the subjects of injuries to the brain and extravasation of blood within the cranial cavity have been considered.

CHAPTER VII.

CONCUSSION OF THE BRAIN AND ITS EFFECTS.

"A MAN receives a blow on the head, by which he is only stunned for a longer or a shorter period. What is said to have happened? Concussion of the brain.

"A man dies instantaneously, or lingers some time perfectly unconscious, after an injury of the head; there are no marks of external violence. Again, what is said to have happened? Concussion of the brain.

"The head is opened, and what is found? In one case no deviation from the healthy structure; in another, simply great congestion of the cerebral vessels; in another, numerous points of extravasated blood scattered through the brain-substance; in another, a bruised appearance in some parts of this organ. In all, the case, in common parlance, is said to have been one of concussion of the brain. Such are the after-death appearances ascribed by different surgeons to concussion of the brain."

These words of an eminent surgeon (P. Hewett) so accurately describe the ordinary teaching of the schools, that I have transcribed them as a fitting introduction to the subject I am about to consider; not that they are strictly in accordance with pathological facts, for such is far from being the case, pathological inquiry leading to the belief that in all cases of death from concussion of the brain, some changes in structure are to be found if carefully looked for, some bruising or laceration of the brain, some bleeding into its substance; in fact, that death from concussion of the brain without change of structure does not take place—that *concussion and contusion of the brain are always associated in fatal cases*. At Guy's Hospital, during the last fifteen years, no case is recorded of death from concussion without change of brain-structure.

Mr. Hewett states: "In every case in which I have seen death occur shortly after, and in consequence of an injury to the head, I have invariably found ample evidence of the damage done to the cranial contents."

Mr. Le Gros Clark, of St. Thomas's Hospital, states: "I have never made nor witnessed a post mortem after speedy death from a blow on the head, where there was not palpable physical lesion of the brain;" and Dr. Neudorfer, of the Austrian army, declares that he has never seen concussion, properly so called, except in apparently trivial injuries.

M. Fano, a recent French writer, has also come to the conclusion, "that the symptoms generally attributed to concussion are due, not to the concussion itself, but to contusion of the brain or to extravasation of blood." In fact, all now agree when death follows a severe shaking of the brain, or concussion, that contusion or bruising of the brain is invariably found.

How far these views are correct in cases of concussion that are not fatal is an open question; but in the few cases of concussion recorded in which death has followed from other causes, some injury to the brain-substance has always been found; and in all instances in which a fatal result has taken place from secondary inflammation, evidence of some bruising of the brain has been detected. Indeed, I believe it would be well for the student to regard all cases of concussion as examples of contusion of the brain, for such a view would tend to a better understanding of the nature, as well as the treatment of these injuries.

There can be no reason why a moderately bruised brain should not recover under proper treatment; and when it is generally accepted as true that concussion and contusion of the brain are synonymous, the principles of the treatment of such injuries will be better appreciated. A bruised brain with a slight extravasation of blood may be recovered from; but with extensive effusion, compression of the brain and death is the usual result. The effects of a bruising, shaking, or concussion of the brain are very variable, and it would be well, perhaps, to pause at this page and pass them in review.

In the simplest form of concussion of a healthy brain the effects are transient, slight loss of power and consciousness being, perhaps, the only symptoms. In the majority of cases, however, when a patient receives a blow or injury which produces some severe shaking of the cranial contents, this shaking is followed by a loss of consciousness more or less complete,

with a loss of all power of motion. If the patient is seen at this time the skin will be cold, the features more or less contracted, the pulse slow and intermittent, the pupils very variable—in some cases dilated, in others contracted, and in a third class one pupil will be dilated, and the other contracted.

If the patient is watched, and the case is not one of great severity, is not complicated with any grave injury to the cranial contents, after a variable period there will be signs of movement; he will, perhaps, move a limb in an impatient and purposeless manner; if he is spoken to with a loud voice, he will, perhaps, show some evident signs of returning consciousness, either by making some inarticulate noise, or by merely opening his eyes, and again returning to his stolid condition.

If the case be still carefully observed, the mode of respiration may be seen to be altered; from being slow and labored, it will be irregular, and perhaps sighing. After a time, if recovery is to take place, other signs of what are termed *reaction* will make their appearance. The skin will become warmer and more natural, the shrunken and contracted features will return to their normal condition, the pulse will be more regular and rapid, and what is very frequent, vomiting may occur. The appearance of this symptom is generally of value, for it denotes the setting in of what is called reaction, and is apparently the first result of a more active circulation through the cerebral centres. If all goes well, the patient rapidly recovers and returns to his natural condition, feeling, perhaps, somewhat heavy and dull for a few days, and indisposed for any bodily, and much less for mental labor. On the other hand, the symptoms may persist or pass into those of compression—complete insensibility, coma, and death; or the symptoms of reaction may become excessive, and pass into those of inflammation of the brain or its membranes.

In this brief sketch of an ordinary example of concussion or shaking of the brain the symptoms are, of course, marked, and have been purposely dissociated from those of complications, occurring either primarily or after the period of reaction has taken place.

What change of structure is present in such an injury is, of course, an open question. In the simplest case, the local injury must be slight; in the most severe, there is every probability that some bruising of the brain, with extravasation, has been produced.

In what is called concussion of the brain, epistaxis is very frequent. Hemorrhage into the lids of both eyes is not uncommon, but beneath the conjunctiva it is very rarely met with. Hemorrhage from the ear directly after the accident is occasionally seen, and I have known it continue for several hours, but in all these cases the extravasation of blood takes place as a direct result of the accident.

In certain cases, again, a patient having regained his consciousness, relapses into insensibility—*relapsing unconsciousness*—from which he may as perfectly recover as if no relapse had taken place. It would appear as if this condition were produced by the earliest effects of reaction, the vessels yielding too freely to the heart's pulsations, and thus producing a plethora of the part, which induces a comatose or semi-comatose condition.

A boy, æt. 11, having received a blow upon the head from a falling piece of timber, became perfectly unconscious and quiescent. He remained in this state for fifteen minutes, and recovering he walked home, some short distance. He soon began to feel sick, and vomited, the vomiting being attended with *epistaxis*. He was then brought to Guy's, with a cold skin and laboring pulse. He was very slightly conscious; refused to answer any questions; and his limbs remained in the position in which they were

placed. The pupils were dilated, but active. He was left in bed with the head raised, and a cold lotion applied to it. Warmth was also applied to the feet. He gradually recovered, leaving the hospital in ten days.

The epistaxis and relapsing unconsciousness in this case, coming together at the time of reaction, point clearly to the cause.

Again, in children, reaction is not infrequently attended with convulsions, which generally, however, pass away, and leave no mark behind. Should they appear in an adult, they are symptoms which cause anxiety, as they almost always indicate brain injury and forebode mischief.

When reaction is excessive it is attended with febrile symptoms and those of brain disturbance, such as delirium, excitement, and coma; but intracranial inflammation will claim attention in another chapter.

If the brain be violently shaken, bruising of its substance and extravasation of blood must take place; when the result of a direct blow, it may be only local, but this is very rare, it being very general to find the opposite side of the brain bruised as well, by what is rightly termed "*contre-coup*." Indeed, it very often happens that the mischief to the brain by *contre-coup* is greater than that at the seat of local injury. When the fall is upon the vertex, the base is bruised; when on the occiput, the anterior lobe; when on the right parietal region, the base of the left middle lobe is the injured part; indeed, the base of the brain is almost always the seat of injury. In all these cases blood will be extravasated to a greater or less degree; and when the vessels are diseased the hemorrhage may be excessive. There will always be some extravasation of blood, either upon the brain surface or within it; if upon the surface, it will be either upon or within the membranes, within the cavity of the arachnoid or the meshes of the pia mater, and under both circumstances the blood gravitates to the base. Not infrequently the extravasation of blood takes place into the structure of the brain itself. It may be found in any part of the cerebrum, cerebellum, or pons Varolii, rarely in the form of one large clot, commonly in small and numerous spots of extravasation.

On referring to my notes, I find in a case of concussion, fatal sixty hours after the injury, that the brain was found bruised all over, and blood generally effused at the injured spots. The fluid in the ventricles was blood-stained, and the ventricles themselves were ecchymosed. In another case of death from concussion, the result of a fall, in a man *æt.* 31, in whom convulsions and coma supervened on the fifteenth day after the injury, a layer of blood was found universally diffused over both hemispheres, dipping between the convolutions and passing downwards towards the base. The clot was shreddy, of a dull, reddish-black color, and had evidently been effused for some days. The surface of the brain beneath the seat of injury was softened, and at the base, where injured by *contre-coup*, like changes had taken place. The vessels were healthy. In another case, where the vessels were diseased and death followed from concussion, multiple extravasations were detected after death throughout the substance of the brain.

In all these typical cases, illustrating the different effects of concussion, a fatal result took place from a severe shaking of the brain only. No fracture existed to complicate the case; but where a fracture is present, unless it be attended with depressed bone, the shaking of the brain is the source of danger.

When the brain is severely shaken some bruising of its structure surely takes place, and the position of the blow, as well as its force, is a sound guide to the seat of the injury; for by a blow the surface of the brain may

not only be injured, but by *contre-coup* the brain may be bruised and blood extravasated at a spot precisely opposite to that at which the injury was received. When the vessels are healthy and the patient is sound, a slightly bruised brain may doubtless recover. When the vessels are diseased and the patient is unsound or feeble, the slightest bruise of brain-structure is likely to prove fatal, and to be accompanied by copious hemorrhage. When the kidneys are diseased this result is rendered highly probable.

The nature of the accident is doubtless the best guide to the formation of an opinion as to the presence of contusion and of its extent; but the severity of the symptoms, or their persistency, is, doubtless, a valuable indication. The French surgeons look upon "tonic spasms of the limbs; intense restlessness, with constant rolling and tossing about in bed; unconsciousness, more or less complete; drowsiness, without any stertorous breathing, and in the slighter cases simply contraction of one pupil or of one eyelid; spasmodic movements about some one muscle or another of the face or lips, giving rise to a difficulty of pronunciation" (Hewett), as symptoms by which this condition is to be recognized. Mr. Le Gros Clark regards the following symptoms as being characteristic of contused brain: "More or less constant restlessness, accompanied by spasm, in which some particular member is affected, or amounting to general convulsion. If capable of giving expression to his feelings, the patient will point to some particular part of the head as the seat of pain. In some instances noisy incoherency and obtuseness of intellect accompany this condition from the first;" and these symptoms are doubtless enough to point to severe injury, to contusion of the brain. When they appear rapidly after the receipt of the accident, they may be accepted as reliable; but when they come on a few days later they are to be accounted for as well by secondary inflammation of the brain as by contusion. Nevertheless, they may be accepted as valuable diagnostic indications of a bruised brain until better ones can be brought forward.

The diagnosis of primary concussion and contusion of the brain is, however, almost impossible. The symptoms are so intermixed that the real nature of the lesion is not apparent. The signs attributed to concussion, such as loss of consciousness, collapse, small scarcely perceptible pulse and lowered temperature, are met with in other affections of the brain, and merely indicate that the functions of that organ, and their influence on the system at large, are in a state of abeyance. It can, therefore, only be declared that the brain was concussed or contused in the first instance, *if the symptoms continue*.

The seat of injury to the brain may likewise be often indicated by some paralysis, partial or complete, of one or more of the cerebral nerves. This paralysis may be only a passing symptom or a permanent one. Paralysis of the seventh pair, including the facial, has been already alluded to as a somewhat typical symptom of fracture through the petrous portion of the temporal bone. This may appear as an immediate result of the injury, indicating its laceration by the fracture; or, what is more usual, at a later date, when it may be the effect of pressure upon the nerve-trunk in some part of its course by effused blood; or, at a still later period, by inflammatory effusion.

On referring to my own notes of cases that have taken place at Guy's Hospital at different periods during the last twenty years, I find examples of injury to the optic nerves, as indicated by blindness, paralysis of the muscles of the globe of the eye as a whole, and paralysis of the external rectus muscle. Paralysis of the facial and auditory nerves is very fre-

quent, and at times there is paralysis of the fifth nerve, as indicated by complete loss of sensation of the face, &c. Paralysis of the lingual is also recorded. In the majority of these cases the symptoms appeared as a direct result of the injury; in some they came on two or three days later, associated with febrile symptoms; but in most, they disappeared after the course of a few weeks. In some instances, however, of facial paralysis the symptoms were permanent. In all these cases there must have been injury to the base of the brain.

Not long ago I had under my care a man who received a severe blow on the left side of the head above the ear; the injury was followed by symptoms of concussion, which soon passed away, but he had complete aphasia; in the course of a few days the ability to speak partially returned, but he spoke so thickly that he was unintelligible; in about three weeks he could be understood, but he did not recover his natural mode of speech for at least three months. During the greater part of this time he had headache, and the least exercise or excess in diet made it worse. There can be little doubt that in this case the base of the middle lobe of the right side had been contused.

"The coexistence of hemiplegia on one side with paralysis of the third nerve of the opposite side is indicative of lesion of the crus cerebri on the side on which the third nerve is paralyzed." (Le Gros Clark.)

CHAPTER VIII.

INJURIES OF THE BRAIN AND ITS MEMBRANES COMPLICATING FRACTURE.

WHEN the student has recognized the fact that a blow upon the head uncomplicated with fracture is capable of producing injuries to the brain, such as have been sketched in the previous pages, he will be quite ready to understand that a blow upon the head complicated with fracture is likely to be followed by results that are at least equally severe; indeed, he will probably expect to find that graver consequences are frequently found associated with such an injury, as the local force required to produce a fracture of the skull must probably be greater than that required to produce what has been described as a concussion of the brain.

All those results which have been ascribed to concussion may consequently be found associated with fractures of the skull; and, in addition, there are certain complications which are more frequently associated with, or are peculiar to, fractures, such as depression of bone producing compression of the brain, extravasation of blood external to the dura mater from rupture of the middle meningeal artery, injury to the dura mater or membranes, and direct injury to the brain. It must, however, be admitted that a fracture of the skull may take place without producing any cerebral disturbance.

A man, æt. 27, received a blow over the vertex from a broken sword; an extensive scalp wound was the result, and a very evident incised wound in the upper portion of the frontal bone, apparently involving only the external table; it was uncomplicated with the slightest cerebral disturbance. A good recovery followed.

A boy received a compound fracture over the frontal region from the kick of a horse; he had no head symptoms whatever, and recovered.

In the former case there was an incised wound of the skull, and in the latter an undepressed fracture. In neither was the brain shaken, bruised, or otherwise injured, and in both a good recovery ensued. Cases such as these are, however, comparatively rare.

The cases next in order of severity are far more frequent than the last. This class includes all those examples of fractured skull which are associated with brain symptoms similar to those that have been described under the head of simple concussion; cases in which the functions of the brain are for a time more or less interfered with or suspended, but which have a tendency gradually to return to their normal conditions. The injury to the skull has been severe enough to break the bone; and general enough to shake the brain, causing a suspension of its functions. The importance of the case, however, rests upon the injury the brain has sustained, and not upon the fracture. The fracture is only a complication, and so long as there is no depressed bone irritating and compressing the brain, the danger of the case is in no way increased; if complicated with laceration of one of the large arteries of the bone, such as the middle meningeal artery, other conditions may arise which are special to fracture.

Fractures of the Skull associated with Extravasation of Blood between the Dura Mater and the Bone.—Small extravasations of blood in this position are not infrequent, as the result of an injury to the skull, whether with or without a fracture; they are the result of rupture of some of the small vessels that pass from the bone to the dura mater beneath. They give rise to no symptoms by which they can be recognized, and are only discovered after death.

Any large extravasation, as a rule, comes from the trunk or one of the branches of the middle meningeal artery, which runs upwards in a groove of the anterior inferior angle of the parietal bone, and divides, supplying the lateral part of the base and vault of the cranium. Any fissure, therefore, of the bone may lacerate one of these branches, and give rise to a copious hemorrhage, producing symptoms of compression of the brain.

It may be well, however, to point out that the brain will sustain a good deal of pressure without giving rise to any symptoms, and that several ounces of blood rapidly effused are required to produce such symptoms as are recognizable. In rare instances the hemorrhage may come from one of the large venous sinuses which has been torn.

The following case is a good one to illustrate the accident.

Case.—A man, æt. 49, when riding in a gig, was thrown out upon his head; the accident produced a scalp wound over the left side of the vertex and some insensibility; this speedily passed away, and he got up and walked for half an hour. He then became confused, and staggered; he went into a shop, and was supposed by the shopkeeper to be intoxicated, but as he gradually became quite insensible he was brought to Guy's. When admitted he was perfectly unconscious and comatose, with dilated pupils, laboring pulse, and slow respiration; he very soon became convulsed, the right arm being more so than any other part; this, however, in a few hours became paralyzed. He remained in this condition two days, and died comatose. After death, upon removing the calvaria, which was fissured in a vertical direction from the middle of the left parietal bone to the jugular foramen, a large clot of blood was seen lying upon the dura mater, clearly proceeding from the middle meningeal artery; it was about two and a half inches in diameter, and more than one inch in thickness; it

formed a *globular tumor*, and caused an extensive depression upon the left cerebral hemisphere; it pressed the longitudinal fissure to the right side.

The brain itself was healthy. Prep. 1606⁸⁰ in Guy's Hosp. Mus. shows the condition. In Fig. 9 these parts are well seen.

This case may fairly be accepted as a typical example of this form of injury, and special attention should be paid to the fact, that the man recovered from the immediate effects or shock of the accident, remained sensible for a definite period, and then gradually became unconscious. In compression from hemorrhage this "interval of time" between the accident and the occurrence of the symptoms is most important in a diagnostic point of view; it is very commonly, although not constantly, present; but when present it is characteristic of hemorrhage in some form. The symptoms to be those of compression must, however, be lasting; and they must not be mistaken for the "relapsing unconsciousness" of a shaken brain, to which attention has been already directed.

But how, it may be asked, is extravasation of blood outside the dura mater, the result of a lacerated meningeal artery, to be diagnosed from extravasation of blood within the cavity of the arachnoid, upon the surface of the brain, or within the brain itself? It may be admitted at once that there are no special symptoms by which these different positions of hemorrhage can be distinguished. In all, the symptoms may appear some time after the accident, the argument drawn from the "interval of time" being the same in each. In all, the symptoms of compression will be identical, for they will be those of apoplexy, and, as, in apoplexy, they will vary in each case. "When extravasation takes places on the surface or within the substance of the brain, it is accompanied and, indeed, produced by lesion of the cerebral texture, which lesion is mostly indicated by paralysis, by irritation or spasmodic action affecting some particular part, by derangement of the pupils, or by other symptoms." (Cock.) When it takes place upon the dura mater the symptoms of compression are generally very marked and very rapidly produced. The paralysis of half the body is also generally complete. The history of the case, when it can be obtained, and the nature of the accident, will, however, always be the surgeon's best guide in aiding him in his diagnosis.

In uncomplicated cases of hemorrhage *external to the dura mater* the injury is generally a local one, produced by a sharp blow or fall; the brain, as a whole, is not shaken or injured.

In cases of hemorrhage *into the arachnoid cavity, or upon the surface of the brain*, the injury is mostly of a general character, such as a fall from a height or a blow from a heavy weight; the whole brain has been violently shaken or "concussed," and as a result its delicate structure, more particularly at the base, has been bruised or lacerated; weak or diseased vessels are, consequently, very apt to give way, producing hemorrhage. In these cases of general injury, it is true, there may be hemorrhage external to

FIG. 9.



Drawing showing clot (b) external to the dura mater (c) from laceration of the middle meningeal artery (a), following a fracture. (Drawing 80⁸⁰, from a case of Hilton's, G. H. M.)

the dura mater, but it will be complicated with the same extravasation into other parts.

This point of diagnosis is all-important, for in the former class of cases, surgical treatment may be of inestimable value, in the latter it can be of no service.

This subject of hemorrhage upon the surface of the brain is very important; it occurs in variable degrees in every case of severe or general injury to the skull. Whenever the head has been severely knocked, or the brain severely shaken, whether complicated or not with fracture, the brain itself may be bruised at the seat of injury, but to a certainty it will be equally, if not more, injured at the opposite point by *contre-coup*; and, as a consequence, this bruising and extravasation is generally found at the base of the brain. The hemorrhage that is associated with this bruising may be very slight, and recovery may take place; or it may be so severe as to give rise to symptoms of compression; at times a large vessel of the pia mater may be ruptured, when the bleeding will be severe; when it occurs, it may spread into all parts down to the base, covering in the cerebellum and spinal cord.

It is this fact that renders all cases of *general injury* to the brain so serious, and tells so powerfully against any operative interference in this class of cases, the surgeon being quite unable to reach the source of compression by trephining.

Hemorrhage into the cavity of the arachnoid is by no means a common form of extravasation in head injury; the effused blood is generally met with upon the cerebrum, sometimes on one side, at others on both sides, and may be the result of a local or direct injury to the skull, or of a diffused one. When the effusion is gradual, and not extensive, it may not give rise to any definite symptoms of compression; and when extensive, there are no means by which it can be known. Pathology has taught us that these clots may organize and form what are now known as blood-cysts, having smooth external surfaces like a serous membrane. When recent, they will be soft and pulpy; when old, fibrous. They may contain only serous fluid, more or less blood-stained, or clots of blood altered by time. Sometimes these cysts are found to be loose in the arachnoid cavity, at others fixed to the parietal arachnoid, and patients have clearly lived for years after the injury that produced this extravasation. There seems reason, however, to think that insanity or diminished brain power may be associated with the presence of these cysts, the result of extravasation of blood from head injury. We are indebted to Mr. Hewett for most of our information on these points.

In patients who have albuminuria, there is reason to think that a slight injury to the head may cause extravasation of blood into the arachnoid, and I have the notes of several cases illustrating this point. The fact itself has an important practical bearing, and gives a key to the solution of many a doubtful case of head injury.

CHAPTER IX.

COMPRESSION OF THE BRAIN.

THE brain may be compressed in many ways; but there are four special causes of compression: Compression from *depressed bone*, the result of fracture, simple or compound: compression from the *extravasation of blood*

into any part of the cranium; compression from the *effusion of inflammatory products* into the brain or its membranes; compression from the *formation of matter* between the dura mater and the bone.

The symptoms of compression under all these different circumstances, are much alike, although the clinical history of the cases and the date of the appearance of the symptoms after the injury varies, in each class. When the result of depressed bone, the symptoms are the immediate consequence of the accident. When caused by extravasation of blood, there is almost always some interval of time between the accident and the accession of the symptoms, although that interval may be but short. When caused by the effusion of inflammatory products into or on the brain, the symptoms generally appear some days after the accident, and are gradual; and when the result of the formation of matter between the dura mater and the bone, the symptoms rarely show themselves for two or three weeks after the accident. In both of the last two classes of cases, moreover, headache and inflammatory symptoms coexist.

The symptoms of compression of the brain are those of apoplexy, and they are as varied in their character. Their severity depends entirely upon the suddenness and amount of the compression. The skull may be fractured and the bone depressed and give rise to no symptoms. Extravasation of blood may also take place to a limited degree within the skull and not be recognized; indeed, there is good reason to believe that a considerable amount of blood may be poured out *slowly* upon the surface of the brain without giving rise to compression, the brain gradually accommodating itself to the pressure. The most marked cases of compression are attended with rapid extravasation. When the bones are much depressed, or the brain is suddenly compressed by the local effusion of blood, symptoms show themselves: complete insensibility, slow, difficult, and perhaps stertorous respiration, and a full, slow, laboring pulse are perhaps the most marked of these. The pupils may be dilated or contracted, but they will be always fixed—they will never respond to light. In very severe cases the respiration will be of a peculiar *puffing* character. There may also be complete loss of the power of swallowing, inability to retain feces, and retention of urine; incontinence or overflow of urine being the last symptom.

When the compression of the brain is general, the symptoms of paralysis will be general, but when the compression of the brain is local, the paralysis may be partial; when local extravasation is extensive, however, the local paralysis may be masked by the general symptoms. The best examples of this form of limited compression are found in cases of fracture of the skull from a local injury, and extravasation of blood between the bone and the dura mater. The case I gave in the last chapter is a good one in point; the following is probably a better one, as it is complete.

J. P—, æt. 46, a painter, having fallen from a height upon his head on a piece of iron, received a severe scalp wound on the right side of the median line of the head, with slight concussion. He was admitted into Guy's under Mr. Cock's care in 1841, conscious, and remained so for eleven hours after the injury; four hours later he was found in a state of perfect unconsciousness, with stertorous breathing and insensible pupils. He continued gradually to get worse. On pinching the left arm and leg they were readily retracted. The right side was completely paralyzed. No fracture could be discovered. Trephining was performed above and behind the anterior inferior angle of the left parietal bone over the trunk of the middle meningeal artery, and a large piece of bone removed. A gush of blood took place, and a large coagulum was removed from outside the

dura mater. The deep stertor at once ceased, and the next day the man moved his right arm and leg freely, and recognized his wife. He progressed favorably after the operation, though recovery was retarded by bone exfoliation. He resumed his work and occupation, and continued in good health for thirteen years. During this period, however, at intervals he had exfoliation of some portion of the skull at the seat of injury; in the ninth year he had fits, which recurred at intervals during the last six years of his life, and the attacks, as Mr. Cock reported, became gradually more frequent and severe in their character. Six months before his death he had paralysis of the opposite side of the body to that of the injury; the face was included in the paralysis, and the speech was somewhat affected. He died after a severe apoplectic fit. After death the brain beneath the injured bone was softened and adherent to the skull; it contained a recent clot of three or four ounces of blood, which filled the ventricles. "It appeared probable," says Dr. Wilks, who made the examination, "that a softening had been going on for some months in the middle hemisphere of the brain, involving the contiguous surfaces of the corpus striatum and thalamus, and that at last a rupture of the vessel had taken place, infiltrating all these diseased structures as well as the ventricles." The trephine opening was filled in by a tough membrane; around its margins there was evidence of considerable otitis having taken place. (Cock, "Guy's Hosp. Reports," 1857.)

An injury to the head followed by local paralysis or hemiplegia generally indicates local injury or compression, whilst an injury to the head associated with general paralysis means a general injury to the brain and compression, although the injury may have commenced as a local one. In the former class of cases the injury has probably been local, and the symptoms are the result of a fracture, with depression of the bones of the skull or extravasation of blood between the bone and the dura mater. In the latter class the injury has probably been general, and is complicated with hemorrhage into the brain itself, upon its surface, or into the cavity of the arachnoid, with more or less laceration of brain-structure. In the first class of cases the injury is remediable by means of the trephine. In the latter it is beyond surgical interference. The diagnosis of these two conditions is consequently a point of primary importance.

When a patient receives a direct blow upon one side of the head, and a fracture with depression of the bone ensues, associated with paralysis of the opposite side of the body as an immediate result of the injury, and a fixed and dilated pupil on the side of the injury, the conclusion is inevitable that the depressed bone is the cause of the paralysis, by producing pressure upon the brain; the depression must, however, be very great to give rise to such symptoms.

When another patient sustains a similar injury, with or without depression of the bone, but followed after a distinct interval of time by paralysis of one side of the body, whether of the injured side or not, it is quite fair to infer that hemorrhage has taken place inside the skull, and is the cause of the compression.

In both of these cases a local injury is followed by local mischief, causing a local paralysis, and surgical treatment is of great promise. In these cases the mode of production of the injury and the history form the surgeon's best guide to its nature. These cases are, however, very rare.

When a patient receives a general injury to the head—such as commonly results from a fall upon the head from a height or a diffused blow from a heavy falling body—and this is followed directly, or after an interval of time, by symptoms of compression, whether associated or not with a frac-

ture, the paralysis is, as a rule, general; and even if more complete on one side than another, the injury to the brain is, for the most part, too diffused or extensive to admit of surgical relief. The case is clearly of a mixed nature, contusion or laceration of brain-structure being associated with hemorrhage.

When a patient suffering from brain shock, with or without a fracture, is unconscious, motionless, and perhaps pulseless, has lost control over the action of the bowels and the bladder, has a feeble respiration and paralyzed pupils, it is impossible for the surgeon to form any opinion as to the nature of the cerebral injury.

These symptoms may be the result of so-called concussion, from which recovery may take place, and not of severe brain contusion. They may be associated with bruising of the brain and extravasation of blood, not sufficient, perhaps, to cause fatal compression of the brain-structure, but enough to set up cerebral symptoms, which cannot pass away for many months under the most favorable conditions. Or they may be accompanied by severe brain laceration or extravasation of blood upon or into its structure, which will prove fatal by coma. The position of the extravasation has then no influence on the symptoms, although it would appear that death is very rapid when it occurs into the ventricles. The primary symptoms of concussion, when severe, and of general compression are identical; they may both be the result of the same kind of accident, a severe brain shake or injury, and they are often not to be recognized. "But," says Mr. Hewett, "there is this marked difference: in concussion the effects are instantaneous, and in compression from extravasated blood some little, it may be very short, time elapses before the symptoms manifest themselves; in the former, also, the symptoms gradually pass off, but in the latter they become more and more marked."

"The diagnostic signs of concussion and compression are, no doubt, distinct in a certain sense, yet compression rarely exists as a consequence of violence without concussion, and both are complicated with shock. Further, symptoms of simple concussion may become developed, at a later period, into those which indicate some more serious lesion; and it is in exceptional cases only that we can identify, with any degree of certainty, the efficient and sole cause of compression. Thus, in the stunning effects which succeed a blow on the head, if we can rouse a patient from his state of unconsciousness, even for a few moments, if the breathing is calm and noiseless, if the pulse is feeble, the pupils are contracted and reflex action can be excited, we conclude that the condition is one of concussion. The intensity of the effects of so-called concussion are marked by the character of the symptoms and by their duration. The probable explanation of protracted somnolence and other evidence of brain disturbance is the presence of diffused extravasation of blood over the surface of the hemispheres." (F. Le Gros Clark.)

In a general shaking of the brain, again, blood may be extravasated into the brain itself. When so-called concussion of the brain was considered this point was dwelt upon, but when the injury has been sufficient to produce fracture there is no limit to the amount of hemorrhage or its seat. "But in dealing with such cases great caution is necessary in order to avoid, if possible, mixing up cases of apoplexy with those of traumatic effusions. An accident coexisting with an extravasation of blood into the cerebral substance does not necessarily imply cause and effect. The previous condition of the brain or the outpouring of blood from diseased vessels may, in fact, have been the cause of the accident." (Hewett.)

From my notes of a case of brain injury which lived only one hour,

blood was found filling the ventricles. In another the ventricles were bruised and the septum lucidum was lacerated. In other cases blood was poured out into the thalamus opticus or the corpus striatum.

In all these cases the brain had been severely shaken, and the hemorrhage was doubtless the result of the shake, the fracture being merely a complication.

And as it has been already shown that concussion of the brain too often means contusion or laceration of its structure, with extravasation, so compression of the brain likewise means equal if not more severe injury; and as the symptoms indicating severe concussion are those of structural brain changes such as have been mentioned, so those of compression are equally mixed in their nature and are equally uncertain. There are no definite symptoms of concussion independent of more severe mischief, and there are no definite symptoms of compression; both these terms applying to injuries of the brain itself, which are more or less complicated with extravasation, and, consequently, with compression. Compression of the brain, when not excessive, is seldom the direct cause of death. It proves fatal in the majority of cases by being the starting-point of an intracranial inflammation. Blood, it has been proved, can be absorbed or encysted, and depressed bone may be gradually raised by the brain itself, or the brain may accommodate itself to the pressure.

Compression of the brain, as a result of traumatic encephalitis, will receive attention in another chapter.

Wounds of the Brain.—In some injuries to the skull the brain may be wounded or lacerated. Brain-matter may even escape from the wound directly after the accident. Such accidents are always of a very grave nature, and, as a rule, are fatal. They may follow any wound; incised, punctured, lacerated, or gunshot. Recovery may at times follow, even after very severe injuries, when no secondary inflammation takes place; but the prognosis must always be unfavorable. Wounds of the anterior and upper portions of the hemispheres are the most favorable; wounds of the posterior hemisphere or base of the brain are the most severe.

When brain-matter is pressed out of the skull in cases of fractured base a grave injury is always indicated, for the crushing force must have been severe to have given rise to such a complication. Some remarkable instances of recovery after the escape of brain-matter are recorded; several have passed under my own observation, but they are too rare to be dwelt upon as holding out any hopes in bad cases. Foreign bodies may likewise lodge in the skull for a long period without causing death. Wounds of the brain are not characterized by any special symptoms apart from those of concussion or compression.

Cases of *hernia cerebri* as a secondary result of injury will claim attention in another page.

Wounds of the dura mater are probably as dangerous as wounds of the brain, for inflammation of the membranes is readily set up by such injuries. It is from this fact that compound fractures of the skull are so serious; that simple fractures associated with comminution of the inner table of the skull are so often fatal; that punctured fractures have so dangerous a tendency; for in all these cases the dura mater is not only torn, but irritated by the projecting spiculæ of bone, and secondary inflammation is the result. This inflammation, as a rule, rapidly spreads over the brain and causes death.

Wounds of the dura mater are, however, recovered from, as are wounds of the brain, but the prognosis in either case must be unfavorable.

A protrusion of brain-matter, mixed with inflammatory products, is often found, as a consequence of the wound of the dura mater, or of a slough after an injury, the result of a compound fracture, with or without brain injury; this is called a *hernia* or *fungus cerebri*. Such cases occasionally recover, the surface of the protruding mass withering, granulating, and subsequently cicatrizing.

CHAPTER X.

INFLAMMATION OF THE CRANIAL BONES, BRAIN, AND MEMBRANES, THE RESULT OF AN INJURY TO THE HEAD.

IN all cases of injury to the head, simple or severe,—of fracture or no fracture,—of concussion or compression,—of injury to the dura mater or the brain,—inflammation of the bones, of the brain, or of its membranes, is very liable to appear, and when it does appear it is most fatal. It is this fact that makes all injuries of the head, even simple contusions of the bone, sources of danger, for inflammation, commencing in the bone, too frequently spreads inwards to the membranes of the brain and the brain itself, and thus destroys life. The free communication between the pericranium and the dura mater, by means of the bloodvessels, through the medium of the diploë of the skull, is a probable explanation of this occurrence in simple scalp and bone contusions. In injuries to the bones of the skull, the brain or its membranes, the liability to encephalic inflammation appears to be greatly determined by the severity of the accident.

In the present chapter traumatic encephalitis, as the result of brain shocks, whether with or without a fracture, will claim attention. This affection is either *acute* or *chronic*.

In *acute encephalitis* the symptoms generally appear on the second or third day following the injury, and pain in the head is the most prominent symptom. The pain may be local or diffused, and it is generally accompanied with intolerance of light and contracted pupils, intolerance of sound, and symptoms of febrility. As the disease progresses wakefulness, restlessness, delirium, and convulsions will probably follow; and then the patient will pass more or less rapidly into a comatose condition, from compression of the brain by effusion, with all its symptoms, and a speedy death will ensue; the effusion taking place into the ventricles or on the surface or the base of the brain.

In *chronic encephalitis* the symptoms may show themselves soon after the injury, but, as a rule, they do not appear for weeks, or even months. They are sometimes the result of an injury; at other times the consequence of chronic otitis, traumatic, syphilitic, or otherwise. They are most insidious in their nature; headache of a constant wearying kind, aggravated by mental or physical exertion, being the most prominent symptom. Want of sleep is a natural consequence, with an irritability of brain and inaptitude of body to any exertion. The patient gradually becomes emaciated and exhausted, and towards the close of the case epileptiform convulsions, local paralysis, coma, and death supervene.

The *acute* cases, for the most part, are the result of a severe *general* shaking of the brain, with or without fracture, complicated with contusion or laceration of the brain-structure or its membranes; they are consequently cases of arachnitis and inflammation of the brain-substance itself,

the inflammation of the membranes being general. "I have never known," says Wilks, "such an affection as arachnitis spring up as a spontaneous disease, and therefore when met with you should always look for some mischief without. When arising in this way, the interarachnoid effusion is often purulent, and so copious that it may pour out when the dura mater is removed. I have never seen extensive effusion into the interarachnoid space without an injury on the head."

The *chronic* cases are for the most part the result of a *local* injury, and begin in the bone, spreading inwards to the dura mater, and at last involving the arachnoid cavity with its two layers of serous membrane, the pia mater, and even the brain itself; local suppuration is frequently found in these cases, either between the bone and dura mater or in the brain itself, from extension of inflammatory action from without inwards, the whole process being in the majority of instances a local one. The same changes take place in all cases of chronic osteitis of the calvaria, whether from accident or disease.

The acute or diffused form of arachnitis is the cause of death in most of the cases of head injury that survive the immediate results of the accident; it comes on in the stage of reaction—indeed, it may be looked upon as reaction in excess—febrile symptoms, convulsions or convulsive twitchings, delirium or mania more or less acute, terminating rapidly in paralysis, coma, and death, being the general sequence of symptoms. Effusion of serum takes place into the ventricles and upon the brain, causing at times compression; or effusion of pus or puriform lymph occurs, either upon the brain itself, or in the meshes of the pia mater, or into the cavity of the arachnoid.

Whenever the brain has been severely shaken, and consequently bruised or lacerated, inflammation may appear at the injured spots; thus it at times shows itself *beneath the seat of the blow*, but more frequently it begins at that portion of the brain that has been *bruised or lacerated by contre-coup*, at the opposite side of the brain to the seat of injury; from these centres inflammation may spread to the membranes from the cortical structure of the brain, or within its substance; thus, in all cases of a general shaking of the brain, the seat of inflammation is, in most cases, at the base. The pia mater and cortical substance of the brain are commonly the seats of inflammation, but the cavity of the arachnoid is likewise involved in many cases secondarily by extension of action. There are no symptoms by which the seat of the inflammation in the brain or its membranes can be made out; they are alike in all.

It will be thus seen that the two classes of cases of acute and chronic encephalitis are in a measure distinct. The *acute* is the result of a bruising of the brain by a severe shaking or concussion, that bruising being, as a rule, at the base of the brain by *contre-coup*; it begins in the pia mater and spreads outwards, and is, for the most part, diffused and not local. It is, consequently, *beyond* the reach of surgical art.

The *chronic* is generally the result of a local contusion or fracture of the bone, and is local in its action; it involves the dura mater by extension from without, and the arachnoid, pia mater, and brain consecutively in the same way. It is, consequently, *within* the reach of surgical art.

TREATMENT.—Acute encephalitis, when following a general injury to the brain, for the most part runs such a rapid course that there is little time for treatment to take effect; it attacks patients, moreover, who have been already knocked down by the injury in more ways than one, in whom there is rarely much resisting force, nor is there, consequently, much chance of success by treatment.

The head must be, of course, shaved and raised on a pillow, and ice applied. There is no remedy more valuable than the application of ice in traumatic inflammation of the head. The bag containing it should be a large one, to cover the whole vault of the skull, and the ice must be broken up into small fragments. The cold douche is a powerful remedy and has been highly spoken of. Free purging should then be used, the old dose of calomel mixed with butter introduced into the mouth being probably the best form; an enema of turpentine or castor oil aiding the work.

With respect to bleeding, much caution is needed. It has been little used of late years in head affections; but in a strong man, when acute encephalitis has come on after a slight injury, it is certainly a sound practice. It should be performed boldly and freely, so as to take effect upon the patient, and at the early part of the disease, before effusion has taken place,—during the state of excitement, before brain oppression has appeared. In severe general injuries it is useless. Some surgeons employ leeching and cupping on the nape of the neck, and speak highly of the practice.

Calomel, combined or not with opium, and given in small and repeated doses to touch the gums, has its advocates. Patients have, doubtless, recovered under such treatment, and it may still be employed. The gray powder in three or four grain doses with five grains of Dover's powder is a useful combination when delirium is present, and larger doses of opium or morphia may at times be given. Great care must, however, be observed in the use of these drugs, for unless carefully given and their effects watched they are injurious, hastening coma. Opium and its preparations are only of use in the onset of the affection.

The French surgeons still employ blisters to the scalp, but they cannot, in value, be compared with the local application of ice in the onset of the disease; in the chronic stage they may be of use. They should be applied to the nape of the neck. When blisters are employed and mercury is given, it may be used in the form of an ointment to dress the blister. Antimony is still given by some surgeons of eminence. I have no experience of its use, and cannot recommend it. When recovery takes place—a rare result—the patient must be cautioned as to the future, for any excess of diet or of mental or physical exercise may bring on a relapse. The greatest quiet ought to be observed for many weeks, and the patient ought to live on the simplest food. Milk diet and animal broths are sufficient for some time, animal food being taken with great caution. Stimulants should be only allowed if the patient's powers are feeble.

When indications of compression of the brain follow these inflammatory symptoms other treatment may be called for, but only when strong evidence of local compression exists.

When the symptoms are the result of acute encephalitis, and, consequently, of a general injury or shaking of the brain, there is little doubt that the compression of the brain is due to effusion of inflammatory fluid into the ventricles, or upon or beneath the brain, and under such circumstances surgical relief cannot be entertained. It is to be thought of only in cases of local suppuration, and these, as it has been already shown, are the result of a local contusion of the bone, injury, or disease, and the symptoms are, as a rule, of a chronic nature. The seat of suppuration under these circumstances is usually between the bone and the dura mater, but at times a local abscess is formed in the cavity of the arachnoid; when strong evidence of this condition exists, the parietal layer may be punctured, good results having followed this practice.

In more advanced cases, suppuration may even involve the brain itself; and it is a serious question whether a surgeon is ever justified in puncturing

this organ with a view of laying open the suppurating cavity. Should good evidence exist of suppuration in the cerebral hemisphere beneath the seat of injury, it is quite possible the surgeon might be justified in making an exploratory puncture, for cases are recorded in which such a practice was successful, but the evidence must indeed be strong to justify such a measure. Dupuytren had a successful case of the kind, and pathological anatomy furnishes examples in which such a practice might have been of use. On the other hand, many bold attempts are on record in which surgeons have punctured the brain to relieve symptoms of suspected suppuration in its substance, but without success. Perhaps the boldest is by Dr. Detmolds, of America. (*"Amer. Journ. of Med. Science,"* No. 37.)

Still, in these cases much may be done—more, indeed, than is usually done—for the relief of symptoms, and I am disposed to think that surgeons are too apt to leave these cases alone too long, and allow them to get beyond relief.

A man receives a blow upon the head, followed by passing symptoms of so-called concussion; he has a slow convalescence, attended, and perhaps followed, by headache. He may display some irritability of brain, inability to do much work, and inaptitude in undergoing any physical fatigue; some febrile disturbance may perhaps manifest itself, but often as not none appears. The pulse will probably be feeble and irritable, at other times slow and laboring. On examining the seat of injury some tenderness on pressure may be experienced, and at times increase of heat will be felt. I have known pressure upon the injured part excite a convulsion where such had previously occurred.

Under these circumstances, fairly indicative of local inflammation of the bone, spreading inwards—but how far is uncertain—a free incision down to the bone is of great value. I have known this operation relieve all the symptoms, general and local, at once, and I have never known it followed by harm. When evidence of local inflammation exists, with undefined and persistent brain symptoms, it should be performed.

When evidence exists that this inflammation has spread from the bone to the parts beneath, as indicated by marked symptoms of feverishness, severe headache, and probably rigors; with sleeplessness, delirium, possibly coma, convulsions, and paralysis, particularly when hemiplegic, other surgical treatment may be thought of; for if these symptoms are associated with such a history as has just been sketched, there is every probability that suppuration exists within the skull, and that surgical art may reach it. General treatment in these cases is both unsatisfactory and unsuccessful; and if the case be left alone bad results always follow. Surgical interference, it is true, is as a rule not very satisfactory, still some striking examples of success exist. In the hand of Pott, trephining the skull for matter beneath the bone outside the dura mater yielded a good result in five out of eight cases. It is true no modern surgeon can show a like success; "indeed," says Mr. Hewett, "the successful issue of a case of trephining for matter between the bone and dura mater is, I believe, all but unknown to surgeons of our own time." Nevertheless, the operation is clearly a justifiable one under such severe circumstances as have been enumerated. I cannot help feeling that Mr. Hewett's opinion is true, because surgeons are too much disposed in these cases of local encephalitis to wait too long, to trust too far to nature's own processes, and by doing so they allow the local suppurative action to spread inwards beyond the dura mater to the brain itself, when the prospects of a successful result are certainly poor. They wait for what are called well-marked brain symp-

toms—coma and hemiplegia—before they interfere; these well-marked symptoms too often meaning fatal brain complications in the disease.

Trephining the seat of injury under circumstances such as I have just indicated is clearly justifiable, and the operation should be performed as soon as it is manifest from the history of the case that the local action is spreading. When pus is found between the bone and the dura mater good hopes may be entertained of a successful issue, and unless the same suppurative action has involved the cavity of the arachnoid and the brain the prospect is a good one.

Should, however, no pus be found in this position, is the surgeon ever justified in opening the membranes? Without doubt he is under certain circumstances, when by the symptoms there is strong reason to believe that pus exists beneath the injured bone, if the dura mater on exposure *bulges* firmly into the opening in the bone which the surgeon has made with his trephine, if it be *tense*, and absolutely *pulseless*. Cases of success after this operation have been recorded by Guthrie, Roux, and Dumville.

The evidence required to sanction any incision into the brain in search of suppuration, as has been already stated, must be very strong; I have never seen an instance in which it was justifiable.

Acute encephalitis, as a result of blood-poisoning, needs only to be mentioned. It is a hopeless case as far as the surgeon is concerned, and is always associated with the worst and most general form of pyæmia.

Hernia Cerebri, or protrusion of brain-matter mixed with inflammatory products, is always the result of a wound or slough of the dura mater, either secondary to a compound fracture or to the removal of fractured or diseased bone with the trephine. It is, probably, always associated with some suppuration (local) of the brain, due to extension of inflammatory mischief to that part in contact with the diseased dura mater and bone. It is to be treated with great caution; some surgeons are in the habit of cutting off the projecting mass, others of applying pressure; but probably the best practice lies in doing very little, in keeping the parts clean and dry, and leaving their repair to natural processes; for should the local affection be so limited in its nature as to be capable of repair, the projecting mass will slough naturally after a time, and then cicatrize, but all interference on the part of the surgeon tends towards harm. The best treatment probably is to apply a piece of lint to the part at first, and at a later stage to keep the hernia dry by dusting it with oxide of zinc or powdered alum. Excision and the application of caustics or pressure, do not appear to be satisfactory forms of treatment.

The experience of the army surgeons during the American war confirms these observations.

CHAPTER XI.

TREATMENT OF CONCUSSION AND COMPRESSION OF THE BRAIN, AND OF FRACTURES OF THE SKULL.

“A MERE crack in one of the bones of the cranium, *abstractedly considered*, is not more likely to produce any serious complaints than a simple fissure in any other bone; and if symptoms of consequence do frequently attend the accident, they proceed either from the bone being beaten inwards, so as to press upon the brain, or from the mischief done to the parts

within the skull by the same force that broke the bone itself. The same violence which breaks the cranium may occasion a concussion of the brain, an extravasation of blood in or upon it, or subsequent inflammation of that organ and its usual consequences." (Sam. Cooper.)

The truth embodied in this extract renders it necessary to consider the treatment of head injuries as a whole; for it is impossible, in any case of severe injury to the skull, to say whether two or more of the conditions mentioned are not associated.

When so-called concussion has taken place, it may or may not be associated with fracture; it may or may not be followed by symptoms of compression, either from extravasation of blood or secondary inflammation. When a fracture is known to exist, either with or without depression of bone, the difficulty is not lessened; the brain symptoms may be simply those of a passing concussion, but they may be those of a much more serious injury—of brain contusion, laceration, or blood extravasation. The severest complications are often ushered in by the mildest symptoms; as a consequence, it behooves the surgeon always to treat every case of injury of the cranium and its contents as a serious one, and to be as guarded in his prognosis as he must be uncertain in his diagnosis. "We know not what injury may have been sustained, or what symptoms may supervene; we therefore wait for the subsidence of the first impressions, or the development of fresh mischief, and shape our course accordingly." (Cock.)

In any case, therefore, of so-called concussion, however slight, the patient ought to be kept quiet for a few days, and ought to observe moderation in diet, particularly in the use of stimulants. If he goes about he does it at a risk, a risk of secondary inflammation of the concussed or shaken brain, which may prove fatal.

In severe concussion, that is, after any injury to the head which is followed by a more or less complete suspension of the functions of the brain, whether with or without a fracture, equal care is needed. Should the collapse indicative of the first stage be severe, it may be necessary for the surgeon to hasten reaction by means of warmth to the body generally, and more particularly to the feet, and by the application of some stimulant to the nostrils. It is rarely right to employ more than this; for if reaction does not reappear naturally, or is not hastened by the means mentioned, it is tolerably certain that the brain mischief is of a severe if not fatal character; and under these circumstances, any more powerful means, such as the administration of alcoholic stimulants or powerful enemata, are likely to excite reaction to excess, and thus encourage inflammation or secondary hemorrhage within the skull.

When *reaction* has set in after the collapse—the *second stage* of authors—every source of excitement, mental or physical, should be removed. The patient should be kept in bed with his head raised and shaved. The bowels should be emptied with a mild saline purgative, or a mercurial purge. If the head be hot, cold lotions or the ice bag may be applied, the latter particularly, if the pulse be rapid and other symptoms of general febrility and brain excitement show themselves. It is at this stage of the affection that the question of bleeding is so important, particularly when the symptoms of reaction in excess are so marked that there can be little doubt as to their indicating the commencement of traumatic encephalitis. In strong subjects I think there can be little question as to the necessity of bleeding. Under these circumstances, active treatment is doubtless required, for when acute symptoms of inflammation of the brain or its membranes appear a fatal coma is not far off.

Venesection boldly performed at this stage of the disease, so as to affect

the pulse, is a good practice. It may even be repeated should the symptoms return and the pulse and temperature rise. I need hardly say that this practice is to be carried out only after careful consideration.

In feeble patients bleeding is inadmissible. Ice to the head or a stream of cold water passed over it are means that ought never to be neglected. Powerful purgation, also, is a valuable practice. The diet must be liquid and of a simple character. Milk, when it can be taken, is the best form, but when it cannot, beef tea or broth should be given, and these in moderation. The reader is referred to Chapter X, on traumatic encephalitis, for further remarks on the treatment.

Concussion of the brain, complicated with undepressed fracture, simple or compound, is to be treated upon like principles, with equal persistency and care. Fractures of the base, also, with concussion, are amenable to the same means; for simple fractures of the vault, compound fractures of the vault, and simple fractures of the base or vault and base combined, *unassociated with displacement*, have no special treatment beyond that indicated by the brain symptoms.

It should be stated here that the treatment of all these cases is to be continued for at least a month or six weeks after the injury, for many are the cases on record in which secondary inflammatory symptoms appeared at least a month after the accident or after the subsidence of the primary symptoms.

When the brain symptoms following an injury to the head partake more of the nature of compression; when they are persistent in their character, and, instead of going on towards a recovery or restoration of the natural functions of the brain, they tend rather towards their more complete abeyance; when, indeed, from these symptoms it is evident that some organic mischief, some extravasation of blood upon or into the brain, some brain compression, exists, other important questions come before the surgeon, and the most important question has reference to the point whether surgical art can do anything towards their relief. It would be well at this stage to stop and consider what the circumstances are that justify surgical interference, for this should only be entertained when a scientific probability of success exists. The surgeon has to show cause why he interferes in any given case. No surgical operation should be performed on the chance of its doing good, unsupported by some reasonable hope of success.

The student who has carefully read the remarks that have been previously made will readily understand, when the injury to the brain or skull has been the result of some general injury, such as a fall upon the head from a height, or a blow from a heavy body, that the brain mischief which follows is certain to be of a general character, and beyond the hope of relief from surgical skill. Should symptoms of local mischief be associated with the case, they will be only part and parcel of a general injury, and no permanent good will accrue from their special treatment; for when a bone of the skull is depressed, or symptoms indicate extravasation of blood between the bone and the dura mater, as a consequence of some severe general injury to the skull contents, there is little use in treating these local symptoms when others of a more general or fatal character exist. In examples of brain or skull injury, therefore, as a result of diffused or general shaking of the head and its contents, local interference of any special character is useless.

In *local* injuries the question may be seriously discussed, for it is in such, and in such alone, that any good result can be looked for.

In cases of *depressed fracture*, ought the bone to be elevated? Should the fact of the fracture being compound influence the decision? I have

little hesitation in answering both these questions, and asserting that in neither instance ought surgical interference to be thought of unless the symptoms of compression are very marked or very persistent; for experience has taught us that depressed bone *per se* may exist to a great degree without giving rise to any serious brain complications, and that even when brain symptoms follow as an immediate result of the injury, they may all pass away.

Should the symptoms indicate the presence of effused blood beneath the fracture, sufficient to cause compression of the brain, as shown by the "interval of time" between the accident and the symptoms; and local paralysis point out its seat; surgical interference is justifiable and called for. The trephine should be employed to elevate the bone under these circumstances in both simple and compound fractures. The operation is necessary on account of the brain symptoms present in the case, and has no reference to the character of the local injury,—to the presence or absence of a scalp wound.

In *compound fracture* of the skull, however, associated with *depression and comminution* of the bone, both with or without brain symptoms, the surgeon ought to remove loose pieces of bone, and may elevate the depressed ones, when this can be done with the elevator without difficulty, for splintered bone is always a dangerous body when in contact with the dura mater.

When the brain is injured the same practice should be followed, the greatest care being observed in not adding to the irritation by any rough manipulation; indeed, should difficulty be felt in removing bone it had better be left *in situ* rather than incur any extra risk of injuring the brain or its membranes by interference.

Should severe hemorrhage take place from a meningeal artery in displacing bone, the piece should be left; and should this practice fail to arrest it, a small piece of sponge tucked in beneath the bone may answer, or the application of a small pair of spring forceps may be called for; it is not often, however, that such a complication is met with.

It would thus appear that in simple or compound *uncomminuted* depressed fracture from a local injury no operative interference is called for, unless associated with marked symptoms of compression of the brain, or extravasation of blood between the bone and the dura mater. In compound *comminuted* fracture, with or without symptoms of brain compression, it is wise to remove all fragments and well to elevate the bone, when it can be done without adding to the local mischief. In all other cases, as in fracture of the base, no surgical interference can be justified.

Did space permit, many cases might be quoted to illustrate these points. Cases of fracture of the skull, depressed bone, and recovery, are numerous; indeed, it is most remarkable how much depression of the bone may exist without giving rise to brain symptoms, and I am almost tempted to believe that depressed bone by itself never gives rise to marked symptoms of compression, and that when these are present hemorrhage exists with it.

Many cases might also be quoted illustrating the value of surgical interference in compound fractures with depression; I give the following:

Compound fracture of skull with depression from local injury. A feeling of permanent weight on the head was the only symptom. This was at once relieved by removal of the bone, and recovery followed.

Compound fracture of skull with depressed bone from local injury. Constant vomiting, and pain in the head. Relieved at once by removal of the bone; recovery on the fourth day.

Compound fracture of skull with depressed bone from local injury. Per-

sistence of symptoms of oppressed brain. Elevation of depressed bone; rapid recovery.

Having now carefully considered the whole subject of concussion and injuries of the brain, including compression and extravasation of blood with or without fracture of the skull, the following inferences may, I think, fairly be deduced. I drew them up ten years ago, when engaged in an analysis of cases of head injuries, and the experience I have had since that time has tended to confirm my opinion of their general accuracy.

General Conclusions.—1. Injuries of the head are of importance only so far as they involve the cranial contents, a simple uncomplicated case of fracture of the skull being of less danger than a general concussion of the brain.

2. A slight concussion of the brain, associated or not with a fracture of the vault or the base of the skull, which manifests itself by a slight or passing suspension of the cerebral functions, generally does well.

3. A severe concussion or shaking of the brain, associated or not with a fracture of the vault or the base of the skull, is liable to produce contusion or laceration of the brain-substance, either upon its surface or within its ventricles, with more or less extravasation of blood, and when the vessels are diseased, a copious hemorrhage often follows a slight injury.

4. In cases of severe concussion of the brain the cerebral structure is at least as much injured by *contre-coup* as at the seat of injury, the base of the brain suffering the most. Fracture by *contre-coup* does not take place.

5. A fall upon the vertex from a height, or a blow upon the head from a blunt instrument, may be followed by fracture of the skull, or not; such an accident produces, as a rule, a general concussion of the brain, with such complications as contusion or laceration of the brain and effusion of blood either upon its surface or within the ventricles.

6. Falls upon a pointed object, and blows with a sharp instrument, as a rule, are followed by a local fracture; and if the brain be injured, it is at the seat of injury. As a consequence, the symptoms may be accounted for by local causes only, and the surgical treatment directed by local considerations.

7. When symptoms of compression of the brain immediately follow an injury to the skull produced by a fall from a height, or a blow from a heavy and blunt instrument, the cerebral injury will be general, the brain contused and lacerated, particularly at the base by *contre-coup*, and if extravasated blood be found external to the dura mater, blood will also be found upon the surface of the brain, or within its membranes.

8. If symptoms of compression of the brain follow a local injury produced by a fall upon a sharp object, or a quick blow from a pointed one, such symptoms, as a rule, are produced by local causes, such as depressed bone, or extravasation of blood from rupture of the middle meningeal artery.

9. Such local injuries, when they give rise to marked or persistent symptoms, should be treated by elevation of the depressed bone; but if no general symptoms are present, unless the bone be comminuted and can be easily removed, no operation is indicated; a local pressure of the brain by bone, although severe, uncomplicated with symptoms, generally doing well.

10. When compression of the brain follows a local injury over the course of the meningeal artery after an interval of time, and when reaction has been established, although no depressed bone be present, the operation of trephining may be performed with a chance of success, the blood often,

however, passing downwards towards the base, where the operator cannot reach it.

11. When compression of the brain follows, as a secondary result, a general injury—although that compression is evidently produced by extravasation of blood—the operation of trephining is useless, if not injurious; for although blood may be effused from rupture of a meningeal artery, there will certainly be found some contusion or laceration of the brain itself, or extravasation beneath its membranes, which the operation cannot relieve.

12. Encephalic inflammation may follow any concussion or injury to the brain, however slight, whether complicated with fracture or not; and the danger of such a result is in proportion to the encephalic injury. In cases of contusion or laceration of the brain, with extravasation of blood, it is almost sure to follow, and, as a rule, it will produce a fatal termination. This inflammation may appear within a few hours of the accident, or it may be postponed for some days; it may be very rapid in its course, or very insidious in its nature. If the brain itself is the seat of the disease, it is generally insidious, giving rise to either a diffused or local abscess; but if the membranes are involved, effusion, convulsions, coma, and death will rapidly take place.

13. The operation of trephining is perfectly useless in cases of severe concussion of the brain, whether associated or not with fracture, although it may relieve compression arising from local conditions; for the brain is generally injured by *contre-coup* at its base, or in positions where no operation can be of benefit, but must prove injurious.

14. The operation of trephining is only of value in local injuries to the skull, when associated with symptoms of compression from depression of bone, or the local extravasation of blood between the bone and the dura mater.

15. Fractures of the base of the skull may take place alone, and be marked by only special symptoms; they may be associated with, and are generally found in, all cases of severe fracture of the vault, when produced by a heavy fall or blow, the fissures radiating downwards in a direction parallel to the forces employed.

16. Fractures of the base may be complicated with encephalic injuries similar to fractures of the vault, and may consequently be manifested by general symptoms as well as special ones; in severe cases the former completely masking the latter. The injury, however, may generally be diagnosed, the mode of its occurrence indicating the probability of its nature.

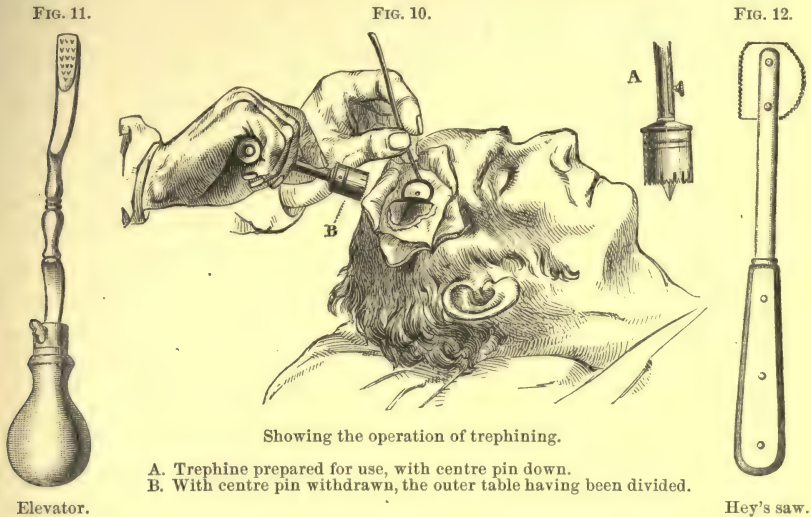
17. All injuries to the head should be treated with extreme care and regarded as serious. Rest in the horizontal posture, freedom from excitement, bland nutritious, unstimulating food are essentials under all circumstances, the great principle of practice being to ward off excess of reaction or inflammation of the cranial contents.

CHAPTER XII.

ON THE USE OF THE TREPHINE, AND THE OPERATION OF TREPHINING.

“MUCH has been written and said on the treatment of injuries to the head; and the result of modern experience and judgment has so far altered the practice of our predecessors, as to render us cautious of inflicting an

additional injury on our patient for the sake of gratifying an impertinent and useless curiosity as to the exact nature and extent of the original lesion." Thus wrote my colleague, Mr. Cock, nearly thirty years ago, and what he then said is as true now, although, perhaps, surgeons at the present day are less disposed to trephine in head injuries than they were even then.



A. Trephine prepared for use, with centre pin down.
B. With centre pin withdrawn, the outer table having been divided.

Hey's saw.

At Guy's Hospital trephining and elevation of bone for head injuries have been performed in fifty-one cases during the last seven years, and of these twelve recovered. At St. Bartholomew's Hospital it was recorded by Callender in 1867 that the operation had not been performed for six years. At University College, Erichsen gives six cases of recovery out of seventeen.

I propose now to consider under what circumstances the operation should be performed.

The operation is likely to be of use in two classes of cases:

First.—To relieve compression of the brain from depressed bone or from extravasation of blood.

Secondly.—To prevent, check, or relieve irritation of the brain or its membranes from depressed and comminuted bone, from inflamed bone, whether the result of accident or disease, or from compression of the brain from the presence of pus between the bone and dura mater; and it may be stated at once that the operation of trephining gains more support from the second group of cases than from the first.

With respect to the first class of cases, it will have been gathered from former chapters that depression of the bones of the skull is rarely sufficient of itself to give rise to persistent symptoms of compression, and that when it is, the injury has probably been of so severe a nature as to produce grave intracranial complications, to which any operation would be incapable of affording relief; and that hemorrhage between the bone and the dura mater is rarely so uncomplicated with brain mischief as to render it probable that the operation of trephining will be a practical success.

When, however, it can be fairly determined that brain symptoms of a defined and aggravated character are the result of either of these two

causes, separately or combined, the operation of trephining may be performed. In diffused injuries to the skull the probabilities are all against the operation; in local injuries they are in its favor.

These observations are particularly applicable to all cases of simple fracture of the skull, with or without depression.

They are also as applicable in compound fractures when the operation of trephining is being considered for the relief of the immediate results of an injury; for in compound, as in simple, fractures, the depressed bone rarely causes symptoms of compression; and extravasation of blood outside the dura mater, sufficient to give rise to symptoms, is not often found. But still, in these cases the elevation of the bone, when depressed, the removal of fragments, when comminuted, either by the trephine or other means, is, without doubt, a valuable practice; the object being under these circumstances to *prevent*, at an early period of the case, and to *check* or *relieve* at a later period, irritation of the membranes and of the brain, which is so liable to pass on to traumatic encephalitis. This question was, however, more fully discussed in the chapter on traumatic encephalitis.

It would thus appear that in both simple and compound fractures of the skull, with or without depression of bone, the symptoms of compression of the brain, as a primary result of the accident, must be very marked indeed to justify the operation of trephining; but that in *compound fractures* it is expedient to elevate depressed bone, when any symptoms of brain irritation manifest themselves, such as local pain and weight, spasms or convulsions; and under all circumstances that it is best to remove fragments when the bone is comminuted, this practice dovetailing in with the principle of practice that should influence the surgeon in the treatment of simple fractures. Trephining in the one case is negatived on the principle that it would only be an additional source of irritation to the membranes of the brain, and is suggested in the other to remove definite sources of irritation that are prone to produce encephalitis, without adding in any way to the danger, for in a compound comminuted fracture of the skull the dura mater is probably exposed, and is likewise irritated by the broken bone. A careful elevation of the depressed portion of bone and removal of the comminuted fragments can in no way add to the mischief, and must tend towards its diminution.

When incipient symptoms of brain irritation or encephalic inflammation appear two or three days after the injury in compound fractures, the use of the trephine is also indicated, particularly after local injuries to the cranium, when there is a probability that the symptoms originate in the presence of a fragment of bone irritating the brain or its membranes; and even after simple fractures the operation may be undertaken when some clear local signs exist to indicate the seat of the mischief.

In diffused injuries to the cranium and its contents all interference is unjustifiable.

When pus can be made out to exist between the bone and the dura mater after a head injury, the operation of trephining is demanded, but the diagnosis of such cases is a task of difficulty. It is true some guide exists in the prolonged period which frequently elapses between the injury and the supervention of the symptoms, their gradual and, it may be said, irregular approach, the general and cerebral irritation that is, as a rule, present, and the exacerbation of all these symptoms, but, above all, the constant headache.

The direct symptoms of compression produced by the formation of pus are, moreover, in no ways so definite as those afforded by blood extravasation; they are of a less decided nature, and are never associated with the

deepened stertor and rapid progress of the symptoms, "which, with overwhelming influence, quickly annihilate both motion and consciousness when blood has been poured out in any considerable quantity after injury to the cranium" (Cock). They are, however, fairly marked by the clinical history of the case, and can be generally recognized.

By way of summary, the following conclusions may be drawn up respecting the use of the trephine in head cases :

1. In *diffused injuries* to the cranium and its contents all operative interference is unjustifiable, as it can only be of use in local conditions.

In *local injuries* to the skull the question of operation may be entertained.

2. In *simple fractures*, with or without depression, and in *compound fractures that are not comminuted*, with or without depression, operative interference is only called for when marked and persistent symptoms of local compression of the brain exist.

3. In *compound comminuted fractures*, with or without brain symptoms, depressed bone should be elevated and fragments removed, with the object of taking away known sources of irritation to the membranes and common causes of encephalitis.

4. In all cases of *local injury* to the cranium, of fracture or other injury, followed by clear clinical evidence of local inflammation of the bone, and persistent symptoms of brain irritation or subosteal suppuration, the operation of trephining should be undertaken.

The Operation of Trephining.—The instruments required for the operation are the *trephine*, or circular hand-saw, of which there are two sizes ; a *small saw*, with a flat and circular edge, generally known as Hey's saw ; a *sharp scalpel*, with a handle rounded at the end, to press back the perosteum and soft parts from the bone ; a *flat probe*, thin enough to introduce into the groove made by the trephine, to guide the surgeon in his attempt to perforate the bone, and to prevent him going too far ; a pair of *cutting forceps*, to remove sharp points and edges of bone ; an *elevator* to raise depressed bone ; and dissecting, dressing, and torsion forceps. (*Vide* Figs. 10, 11, 12, page 85.)

The patient's head having been placed upon a pillow, *shaved*, and held firmly, the first point the surgeon has to do is to expose the bone he wishes to perforate or elevate. This must be done freely, either by enlarging the wound that previously existed or by a crucial incision. The soft parts should be divided by one cut down to the bone, and these, including the periosteum, should be gently pressed back with the hand of the knife. Bleeding at this stage should be arrested by ligatures, torsion, or the application of a cold sponge and pressure.

Supposing the case to be one of fracture with depression, and that fragments of bone exist, they should be removed, great care being taken in their removal not to twist the broken bone, and thus run the risk of tearing the dura mater ; should an opening thus be formed, the depressed bone may be raised by means of the elevator carefully introduced beneath its free border. To facilitate this proceeding, perhaps the removal of a piece of projecting bone by forceps or Hey's saw will be found of use, and if so the trephine is not required ; for the surgeon's object, under these circumstances—to raise the depressed bone and remove the comminuted portions—may be completed without the trephine.

Should the bone, however, be so depressed as not to present an edge for the surgeon's forceps, as is seen in the "gutter" fracture illustrated in Fig. 3, the trephine must be employed. The instrument should be previously prepared, and the central pin made to project sufficiently far to perforate

the external table, and fixed to allow the saw to bite the bone. (Fig. 10 A.) In a depressed fracture this pin *should never be placed upon the fractured bone*, but upon the border of the sound bone. The instrument is then to be applied, and the external table boldly and rapidly divided with a few semi-rotatory movements of the surgeon's wrist. A groove having been made deep enough to allow the saw to work steadily, the instrument is to be removed and the central pin withdrawn and fixed (Fig. 10 B), for it would be a fatal error to go on working with the pin projecting through the inner plate of bone into the dura mater. The surgeon is now to proceed with the utmost caution; he is to feel his way every few turns with the flat probe, for as soon as he has divided or even reached the inner plate the elevator may be employed and the loose ring of bone removed. Where the inner plate is fractured to a greater extent than the outer, it may not be necessary to divide it, the removal of the external table with the diploë being enough to allow of the introduction of the elevator, and the elevation of the depressed inner table or the removal of fragments. Should this, however, not be the case, the inner table must be perforated, although with the greatest caution, for it is to be remembered that the calvaria is thicker in some portions than others. The whole thickness of the bone must be removed.

The operator cannot be too careful in this stage of the operation; he should always proceed with the conviction that the bone is thinner at one spot than at another, and that "there is only the thinness of paper between eternity and his instrument" (Sir A. Cooper's MS. Lectures). The depressed bone may then be raised by the elevator.

Should the operation have been performed for extravasation of blood beneath the bone, and a clot is discovered, it should be turned out; the utmost gentleness being observed. Should pus exist, it will escape naturally.

Should troublesome hemorrhage from a meningeal artery take place, it may be arrested by tucking a small portion of sponge or a small piece of wool beneath the vessel and compressing it against the bone, or it may be held by a short pair of spring forceps against the bone. But free bleeding from this source is not frequent.

Should, however, no blood or pus be found external to the dura mater, and strong evidence exists that it is placed beneath this membrane, the dura mater may be punctured. This step, however, is not to be undertaken without grave consideration. But, it may be asked, if the operation fails in its object, is the operator ever justified in making a second opening into the skull in search of blood or of pus? Certainly not at a hazard, it must be answered, although when evidence points to a second position in which it is scientifically probable that the offending fluid may be found, a second perforation may be performed; for cases are on record in which three or more pieces have been removed with a good result.

The wound, after the operation, must be treated on general principles; the edges may be gently brought together, but not stitched; water-dressing is probably the best application, the head being kept cool by the ice-bag. Should the parts heal, and the case do well, a metallic shield will probably be required as a protection, although it is interesting to see how firm the membrane that fills in the cavity becomes after a time.

Should a hernia of the brain follow at a later stage, the same local treatment is to be employed. Excision of the projecting fungous mass is a practice which cannot be advised. The whole thing will probably wither by natural processes when a cure is to take place, and the less the surgeon interferes the better.

CHAPTER XIII.

DISEASES OF THE SCALP AND CRANIUM.

BESIDES the blood tumors of the scalp to which attention has been directed (Chapter V), the head is very frequently the seat of the common skin or *sebaceous tumor*; indeed, these morbid growths are more frequently found on the head than on any other part of the body; they are more common in women than in men, and are often called "wens;" out of one hundred and seven consecutive cases of sebaceous cysts which I have analyzed, seventy were in women and eighty-four were on the head. In many examples they are doubtless due to an obstruction of the duct of a sebaceous follicle; for the orifice of the duct is often visible, and through it the contents of the cyst can be squeezed; but in others no such obstruction can be made out, and it is probable that some of these tumors are new formations—true adenoid tumors of the skin. In such, the tumor lies beneath the skin, but has no connection with it. In *congenital* sebaceous tumors, this position is very common, although, perhaps, the cyst is more frequently situated beneath the fascia, or even the muscles of the part. When about the orbit—their most common seat—these cysts are always deeply placed, and have often close connection with the periosteum. They moreover almost always contain hair. By their pressure upon the bone they at times cause its absorption and perforation. The contents of these cysts vary; in some the secretion is milky, in others more solid and cheesy; in some, again, the contents are cretaceous. When degenerating, they may be filled with a blood-stained blackish fluid, and at times they are most offensive, having a peculiar sour smell.

In neglected examples of this disease the contents of the tumor may soften down, and causing suppuration, escape externally by ulceration. From the inner surface of these evacuated cysts a new growth may spring up, which is of a peculiar nature; and this forming an irregular, fungating, bleeding surface, at times puts on an appearance which has been mistaken for cancer. On examining the edges of the wound, however, this mistake can hardly be long entertained, for it will be at once observed that the edges of the wound are healthy, and not infiltrated with new matter, as would be the case in cancer, this irregular fungating growth consisting of exuberant granulations from the cyst itself. Abernethy described these growths years ago, but in more modern times the best account is given by Mr. Cock, in "Guy's Hosp. Reports," 1852.

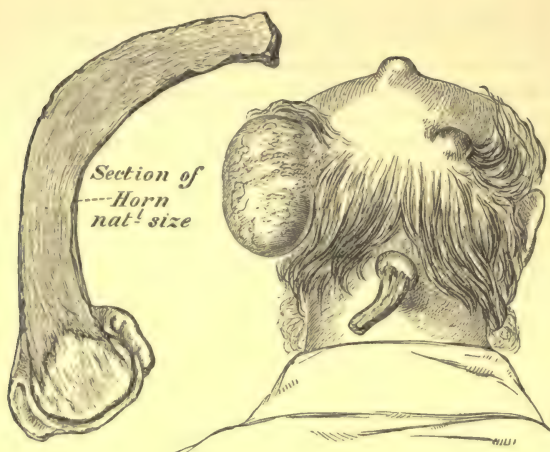
In other cases, again, a horny growth springs up from the interior of the cyst. These points are illustrated in Fig. 13, taken from the head of a man æt. 70, upon which were wens of different sizes, and a horn of twenty-one years' growth.

TREATMENT.—The only correct treatment of these cysts, whether whole or broken, is their removal by excision. It is needless to be too careful in dissecting the cyst out entire, as was formerly done, the most expeditious method being to slit open the tumor with a bistoury, and turn it out with the forceps or handle of a knife. This plan is rapid and effective, and far superior to the older and unnecessary one of a steady dissection. In children, however, they may frequently be squeezed out of their bed by the thumb and finger.

The fear of erysipelas after these excisions is groundless. The excision of the congenital tumor is sometimes difficult on account of its close at-

tachments, and unless all the cyst is removed a return of the growth may be looked for. Some surgeons consequently advise the careful dissection of the cyst; I have generally found, however, a free incision into it, and the removal of its walls by the scalpel or scissors, sufficient.

FIG. 13.



The scalp may likewise be the seat of other tumors, *simple* or *malignant*, of *epithelial* cancer of the skin, or of any other affection of the integument; but these cases require no special attention here.

Nævi are very common in all their forms—cutaneous, subcutaneous, or mixed. This subject will be considered in another chapter. But let me caution the student not to touch surgically any case that is situated over a fontanelle, for I have known a fatal inflammation attack the membranes of the brain after the application of a ligature to an undoubted cutaneous nævus placed over this region. Let him wait if possible till the bones have closed before he interferes.

Perforating Tumors of the Skull occasionally come under the surgeon's notice, and demand attention. The majority have their origin from the membranes covering the brain, and mainly from the dura mater. They are generally *cancerous*, and are often secondary deposits; occasionally, however, they seem to be of the "*fibroplastic*" nature. They were first described by Louis in 1774, under the term "*fungus of the dura mater*" ("*Mém. de l'Acad. Roy. de Chir.*," tome v), and since his day all perforating tumors of the skull have been included under this heading: it must be remembered that a tumor growing within the skull, and pressing outwards, will cause absorption of the cranial bones, and this fact is rendered familiar to pathologists by the enlargement of the Pacchionian bodies.

The symptoms indicating the presence of this affection are very uncertain—headache, more or less constant and severe, may exist with epileptiform convulsions and other brain symptoms; but, as often as not, the first marked condition to which the patient's attention is directed is a swelling in one of the bones, the disease having progressed thus far without giving rise to any symptoms whatever. When the disease has perforated the bone the swelling will be a pulsatile one, receiving its impulse from the brain, and this symptom is of importance, for it is a distinctive one between tumors of the bone itself and the perforating tumors of the membranes.

In cancerous disease the bone itself will be infiltrated with cancerous elements and destroyed. In benign tumors the bone will be absorbed simply by pressure, as is seen in aneurism. In the former case the opening in the bone will be ill defined and irregular, in the latter it will be smooth and regular.

With respect to treatment, it is almost needless to say that nothing can be done by way of removal of the growth. The symptoms it causes can only be relieved by sedatives, and life prolonged by general treatment.

The bones of the skull are liable to tumors, cancerous or benign, to exostoses, particularly of the ivory kind, and to myeloid growths; but in this place it is only necessary to mention the fact.

Meningocele and Encephalocele.—These two conditions are found in the heads of children at the time of birth, and infants thus affected are generally hydrocephalic. They are really hernial protrusions of the membranes of the brain, or of the brain itself, and are analogous to cases of spina bifida. They are always associated with some deficiency of the bones of the skull, it may be of some portion of the frontal bone, near the root of the nose, or of the parietal, but by far the most frequently of the occipital. In rare examples the deficiency may be at the base of the skull. Dr. Lichtenberg has recorded, in the "Transactions of the Pathological Society," vol. xviii, a case in which the tumor was hanging out of the child's mouth, and communicating with the skull through an opening in front of the sella turcica.

In a *meningocele* the membranes, as a whole, may protrude; but sometimes the dura mater alone projects (*vide* Prep. 1563⁶⁰, Guy's Museum).

In a third class, the true *encephalocele*, the brain itself is pressed out of the skull into the external tumor. This was well seen in a patient of Dr. Lever's, from whom the accompanying drawing was taken, for the skull contained the anterior and part of the middle lobes of the brain and the sac the remaining portions. The ventricles were likewise divided between the two. The posterior lobes were adherent to the membranes that formed the sac.



FIG. 14.

Drawing 501²⁰. (Guy's Hosp. Mus.)

When these tumors are small, and have a very minute communication with the cranial contents, they have been and may be again mistaken for some simple cyst or tumor. The surgeon should, however, always suspect that a tumor of a cystic nature, situated over a fontanelle or suture, and in the median line, particularly when over the nose, may have some communication with the membranes, and consequently postpone all interference till the diagnosis is clear. As the bones ossify, the opening between the tumor and the cranial contents may close. The cyst, if a small one, may then be excised; if a large one, injected with iodine. The utmost caution, however, must be employed in the treatment of these cases, and where uncertainty exists as to their true nature or attachments, the prudent surgeon had better leave the case to nature than risk life by any hazardous enterprise.

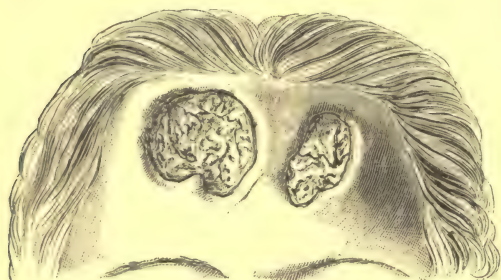
Ostitis and Periostitis of the Bones of the Cranium are common affections. They occur as a consequence of a local injury, as a result of syphilis, and other causes. They are also often associated with brain complications. In the chapter on traumatic encephalitis this subject was discussed, together with its treatment, and ostitis coming on from any cause other than injury

presents symptoms very similar. I have seen periostitis in an infant, the result of hereditary syphilis, and osteitis ending in necrosis. I have seen half the frontal bone exfoliate in a babe after a punctured wound from a nail, without any brain symptoms; and in the adult the complications attending inflammation of the bones, syphilitic or otherwise, are very variable.

So long as the inflammation is confined to the periosteum covering in the bone the symptoms are generally local—pain and tenderness, with local swelling, being probably the chief. But when the inflammation involves the inner periosteum or dura mater, other symptoms appear. Headache is the chief symptom, and this is, as a rule, constant; it is, moreover, frequently associated with an irritable brain; any worry or work increases pain, causes fever, restlessness, and want of sleep. As the disease progresses delirium, convulsions, paralysis, coma, and death, may be the result.

The inflammation in the bone may go on to suppuration or necrosis, and the dead bone may then exfoliate in masses (Fig. 15) or in small portions.

FIG. 15.



Necrosis of frontal bone (from Emily S—, æt. 19). June, 1870.

Should no external outlet for the pus exist, it will press inwards and aggravate the brain symptoms; indeed, if no external vent to the suppuration be made, either by natural processes or by the surgeon, the retained pus within the skull may give rise to symptoms of compression of the brain, to arachnitis, or to abscess of the brain. When the symptoms of compression

of the brain from suppuration, the result of bone disease, make their appearance, it is probable that the brain itself and its serous membrane are also involved, and the case becomes a most serious one. It is, consequently, a point of great importance for the surgeon to anticipate such a complication, and, if possible, to prevent it, and this leads me to speak of the treatment of the affection.

When a patient has had a blow upon the head, or been the subject of syphilis, and as a result a local swelling appears, or local pain of a constant and wearying character, the suspicion of its being due to a local osteitis should be excited. When this swelling is tender to the touch, and pain is aggravated by local pressure, this suspicion should be strengthened; when these conditions are attended by pyrexia more or less severe, sleeplessness, a quick irritable pulse, and a contracted pupil, there can be little question as to the local condition that exists. When these symptoms are present, and the diagnosis is made of local inflammation of the bone, probably involving the dura mater within and the periosteum without, there can be no question that a free incision down to the bone is the right treatment, for it is true that by the adoption of this practice, pain and other symptoms are, as a rule, relieved, and, as a consequence, serious brain complications often prevented. When external suppuration is present, with the exposure of dead or dying bone, it is less common to meet with the same cerebral complication, for the pus finds its way externally through the wound, and there is less irritation and pressure on the dura mater, and less brain irritation. Should, however, brain complications be present, it is important for the surgeon to interfere, and thus try to prevent their spreading, for when

confirmed brain symptoms exist, the case is almost hopeless. The surgeon, under these circumstances, may try to remove the necrosed bone, or perforate it by the trephine—having one common object in both these operations, viz., to give free vent to the suppuration that exists beneath the bone, and which is the source of the brain mischief.

Trephining, under these circumstances, is not only a justifiable, but, probably, a valuable operation, and if done with care, can do little harm. When interference is postponed till confirmed brain symptoms appear, there is too much reason to believe that irremediable changes have taken place, such as suppuration within the hemisphere or arachnitis, which no operation is likely to relieve. Trephining has, however, been of use in these cases when complicated with epileptiform convulsions; but it would always be well for the surgeon to anticipate this stage of the disease when he can, and to interfere before such symptoms appear. Headache of a local and persistent character, associated with evident signs of local ostitis or necrosis, are strong arguments in favor of surgical interference.

I need hardly add that constitutional treatment—such as has been mentioned in the chapter on encephalitis and will be alluded to when the subject of syphilis is considered—must be carefully followed.

M. Aran, "Archives Générales de Médecine," 1844.—*Cock*, "Guy's Hosp. Reports," 1842.—*Hewett*, "System of Surgery," by Holmes. Sec. Ed., 1870.—*Le Gros Clark*, "Lectures at Royal College of Surgeons," 1869.—*Pott*, "Injuries of the Head," 1768.—*Guthrie*, "Commentaries in Surgery," 1853.—"Erichsen's Surgery," 5th Ed., 1869.—*Hutchinson's Prize Essay* (Astley Cooper), 1865.—*Brodie*, "Med. Chir. Trans.," vol. xiv.—*Wilks*, "Lectures on Pathology."—*Callender*, "St. Bartholomew's Hosp. Reports," vols. i and iii.—*Hilton*, "Clinical Lectures," "Lancet," 1853.—*Nelaton*, Attler's edition, 1855.—*Gama*, "Traité des Plaies de Tête," 1835.—*Adams*, "Cooper's Surg. Dictionary," 1801.—*J. Neudörfer*, M.D., Prague, "Handbuch der Kriegschirurgie," 1867.—*Pirogoff*, N. Leipzig, 1864.—*Stromeyer's* edition of *W. McCormack's* "Notes of an Ambulance Surgeon," 1871.

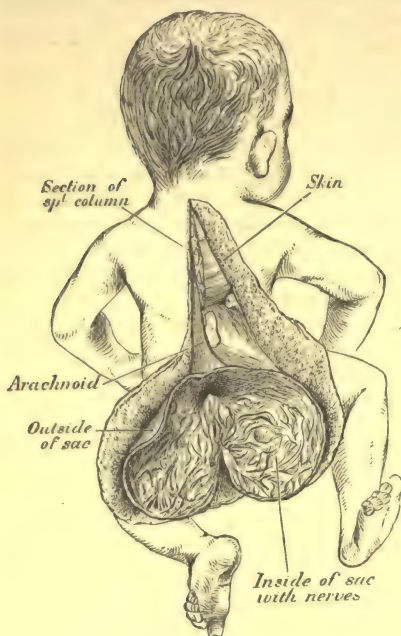
CHAPTER XIV.

SPINA BIFIDA.

A SPINA BIFIDA is essentially a hernia of the membranes of the cord through an opening in the spine, due to a congenital deficiency from arrest of development in some portion of the bones forming the spinal column. It is analogous to the meningoceles already described. It always contains subarachnoid fluid, and often the spinal cord itself or large nerve-trunks. Mr. Hewett believes that when the fluid has collected in the subarachnoid space, or between the cord and the membranes, the latter condition exists; and that when fluid alone is present, the collection is situated in the cavity of the arachnoid. Mr. Hutchinson has recorded ("Path. Trans.," vol. viii) a case in which the serous sac in the cauda equina had a direct tubular communication with the cerebral ventricles; and in the specimen figured below (Fig. 16), taken from a dissection kindly made for me by Dr. Pye Smith, there was a funnel-shaped opening leading from the centre of the cavity into the cord, which was clearly the persistent central canal of the cord, the nerves being spread out under the internal lining of the sac, and thus forming one of the layers of its wall.

The spinal hernia is at times covered by the whole thickness of integument; at others, the external integument is thin; while in a third class the

FIG. 16.



walls are represented by a transparent membrane. This last condition was present in ten cases out of twenty-seven that have fallen under my care. The tumor may have a broad base and free communication with the spinal canal, or a narrow and more or less pedunculated one. Under the former circumstances, the probabilities of the cord being directly involved are greater than under the latter. The tumor is always more or less globular, tense, and elastic. When the child is asleep or quiet it may be soft; but when it cries it will rapidly fill out. The edges of the bony orifice are occasionally to be felt.

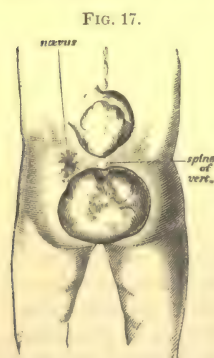
The integument is in some instances ulcerated even at birth; in others there will be a small opening in the walls, through which the serous spinal fluid exudes. A nævus is by no means rarely found situated over the tumor.

The tumor is often associated with hydrocephalus, and in exceptional

examples is double. (Fig. 17.) Other complications, such as club-foot or paralysis of the lower limbs, are frequently present, with it. Under such circumstances it is tolerably certain that the cord is included in the hernia,

the nature of the deformity being determined by the special nerve complication. Incontinence of urine or of feces may coexist with the paralysis, or be independent of it. Paralytic symptoms are more common in the broad-based hernia than in the narrow.

The lumbo-sacral portion of the column is more frequently affected than any other; but the cervical, dorsal, and sacral portions are also liable to the defect. Thus, in twenty-seven examples which have come under my care, thirteen occurred in the lumbar region, four in the lumbo-sacral, and nine in the sacral. One was double, a small tumor being in the lumbar and a large one in the sacral region. (Fig. 17.) Twelve of these cases were uncomplicated with any paralysis or deformity. In eleven there was incontinence of urine and feces, and in four of these paralysis of the lower extremities. Four



Double spina bifida (from Eliza F—, æt. 3 months).

were complicated with hydrocephalus, two with nævus, and one with talipes. I have seen but one example in which the tumor was in the cervical region. When the tumor is complicated with hydrocephalus, fluctuation may often be felt between the two parts, pressure on the head causing a fulness of the spinal hernia, and *vice versa*.

Diagnosis.—In a general way there is no difficulty in diagnosing a spina bifida. In any infant a congenital tumor over the spine is probably a spina bifida; if globular and tense, or capable of becoming tense when the child cries, the probabilities are almost converted into a certainty, inasmuch as the only cases for which this affection is liable to be mistaken are congenital tumors unconnected with the spine—cystic, fibrous, fatty, or foetal tumors. These may be hard and tense, but they are rarely, if ever, made so much more tense by the child crying as the spinal hernia is.

Prognosis.—By far the majority of these cases prove fatal. Many of the subjects are ill-developed, and they die within a few days of birth. Some die in convulsions; this mode of death is very usual when the sac bursts and its fluid contents escape. The rupture of the sac is not, however, necessarily followed by this result; it is to be expected only when the fluid rapidly escapes. I have a case now under observation of a child three years old in which at birth the tumor was transparent and soon burst; it has discharged at intervals ever since, but upon the whole the tumor is contracting and becoming more solid. It promises to be an example of a natural cure, which does at times take place by the gradual approximation of the bony walls and closure of the orifice of the hernial sac. The more pedunculated the tumor the better the prognosis, as long as no complication exists that threatens life.

TREATMENT.—Palliative and preventive treatment is all that can be followed in the large majority of cases. In exceptional instances operative interference promises to be of use. The tumor must always be guarded from injury by some soft protective material, such as cotton-wool or spongopiline. Slight pressure just sufficient to prevent its rapid increase is also good, a casing of gutta percha or felt moulded to the part being the best mode of applying it. The application of collodion is sometimes useful.

Successful cases are recorded in which tapping of the hernia has been performed. It is however, a dangerous practice, for the drawing off of the fluid has been followed by convulsions and death. Nevertheless, it is the least formidable form of practice that can be undertaken, and should always be employed before more active treatment is resorted to, if only as a preliminary measure. The puncture should always be made at the side of the tumor, for the cord when present is more likely to be placed in the median line. The whole of the fluid should never be drawn off. Other forms of treatment have been employed, such as the injection of the tumor with iodine, also excision and ligaturing of the tumor in many ways, but in all the success has been very poor. Exceptional cases are on record of recovery after every form of practice, but upon the whole the result is a most discouraging one.

Mr. Holmes speaks somewhat favorably of the practice by injection, and believes it to be often harmless. When performed, the fluid should only be partially withdrawn, and four or five drops of the tincture of iodine diluted with a drachm of water injected. The strength of the injection may be increased on each occasion, the object being to excite a slow process of inflammation in the cyst. In no case where the base or neck of the tumor is large should this or any other operation be performed, for it will be injurious; nor in those cases in which it is evident the cord is implicated or large nerve-trunks are involved. In pedunculated tumors it may be attempted. In these the neck of the sac should be occluded at the time by the pressure of the finger, clamp, or ligature.

With respect to the *excision* of the tumor, a successful case has been recorded in the "Path. Soc. Trans.," vol. xiv, in which Dr. Wilson, of Clay Cross, removed the tumor five days after the closure of its neck by

means of a clamp. A good recovery followed; and when excision is entertained this plan is probably the soundest. It should, however, only be thought of when the neck of the tumor is narrow and there is no evidence of the spinal marrow or nerves being involved in the disease. In pedunculated tumors in which the neck is narrow, and there is no paralysis of the lower limbs or incontinence of fæces or urine, the plan of treatment adopted by Dr. Wilson may be employed, but in all broad-based tumors associated with paralysis all operative measures had better be left alone.

Sacral and Coccygeal Tumors.—Congenital tumors are by no means infrequent in the neighborhood of the coccyx or sacrum. They are sometimes composed of cysts, sometimes of fat or fibre tissue, and occasionally of fetal remains. They are generally central. Many of these tumors have, doubtless, been described under the heading false spina bifida, and in rare examples there is reason to believe they are cured cases of spina bifida, the sac of the hernia having been occluded at its neck by the natural contraction of the parts around. I have seen one case of this in an adult where the tumor was successfully excised. Mr. Pollock has recorded, in the eighth volume of the "Path. Trans.," an example of congenital fatty tumor which he successfully removed from the central lumbar region of a child æt. seven; and Mr. Athol Johnson, in the same volume, a rare example of fatty tumor clearly developed in the spinal canal itself. I have had occasion to remove, from a child æt. ten, a large congenital sebaceous cyst placed between the anus and coccyx, and from another child a tumor containing fetal remains, situated between the sacrum and the bowel. I may also refer to a third interesting case of cystic tumor of the sacrum, possibly spina bifida, which burst, and is now going on to recovery. The following are the brief notes of the two latter cases.

Marie B—, æt. seven weeks, was brought to me by Dr. Billingham, of Islington, in 1868, with a congenital tumor the size of a large orange projecting from between the bowel and coccyx; it apparently passed up in front of the bone. (Fig. 18.) It had been growing rapidly since birth, and was pressing upon the bowel; the child in all other respects was healthy. I excised the growth on February 20th, and found that microscopically it was made up of fat, fibro-cellular tissue, mucous membrane, cartilage, and bone elements. Good recovery ensued and the child is now well.

FIG. 18.



FIG. 19.



A male child, two days old, was brought to me on July 30th, 1868, with a large cystic tumor covering in the lower half of the sacrum and occupying the perineum (Fig. 19); it was the size of a cocoanut, and transparent as a spina bifida; in all other respects the child was well formed. The next

day it burst, and many ounces of a blood-stained fluid escaped. The sac collapsed; no evil result followed this bursting of the cyst. I watched the child for many months, and, on November 30th, the tumor had contracted up to an irregular indurated mass of integument. The child was a very healthy one.

TREATMENT.—The only right treatment is the excision of the growth, and this should be the general practice unless symptoms exist to contraindicate any surgical interference, such as extensive or dangerous connections of the tumor. Care should always be taken that no communication exists between the tumor and the spinal canal.

Hewett, "Med. Gaz." vol. xxxiv.—*Behrend*, "Journ. f. Kinderkrankheiten," vol. xxxi.—*Nelaton*, "Path. Chir.," vol. ii.—*Holmes*, "Surgical Treatment of Children's Diseases," 1869.

CHAPTER XV.

INJURIES OF THE SPINE.

THE spine is a flexible tubular column composed of ring bones, alternating with a dense elastic intervertebral substance; these bones articulate by means of joints, and are bound together by strong yet elastic ligaments. From the upper orifice of the tube the spinal cord with its membranes is suspended in a chamber filled with cerebro-spinal fluid, and surrounded by large venous plexuses. The cord and its membranes are held in position by the nerve-trunks that pass outwards between the bones with the processes of dura mater that accompany them.

A local injury to the spine, such as a forcible bend forwards, may sprain or lacerate the ligaments that hold the bones in position. A still more forcible bend may crush the bodies of the vertebræ that form the anterior portion of each ring. If the force be still continued upon the broken bones displacement may take place, when the delicate cord itself will either be slightly pinched between the displaced bones and contused, or completely crushed or divided. In the cervical and lumbar regions the bones may be dislocated, the amount of injury to the cord depending entirely upon the amount of displacement that has taken place. When the displacement is very slight the cord may be uninjured. Sprains of the back may also, at a later period, be followed by disease both of the joints and bones of the spine.

A diffused injury to the spine, such as that caused by a fall from a height upon the back or by a heavy falling body, or a severe shaking, as from a railway accident, may produce some fracture or dislocation of the bones of the spine, but it will to a certainty cause a severe shaking or concussion of the spinal cord itself, that may manifest its existence by a more or less complete suspension of all functions of the cord, either for a short period or for life. This concussion of the spine may be accompanied with hemorrhage into or upon the cord, giving rise to compression, or may be followed by acute or chronic intraspinal inflammation, terminating in paralysis and death.

In both local and diffused injuries of the spine the gravity of the case depends much upon the amount of injury the cord has sustained; a severe local injury to the spine being quite capable of complete repair without en-

dangering life, if the cord and its membranes are uninjured, whilst any injury to these is fraught with danger, either directly by suddenly arresting the functions of the parts to which the injured nerves are distributed, or indirectly by setting up chronic inflammatory changes which end in paralysis.

When the functions of the cord have been directly suspended by any injury, local or diffused, it is said to have suffered from *concussion*. Should the symptoms be complete and persistent, there is good reason to believe that the cord has been crushed by some displacement of a fractured or dislocated bone. Should some interval of time have taken place between the receipt of the accident and the paralysis, there is a fair suspicion that the paralysis is the result of some hemorrhage into or around the cord. Should the paralytic symptoms have followed the accident after a few days, and have been attended with constitutional disturbance or spasm of the muscles of the limbs, the cause of the paralysis has probably been some inflammation of the cord and its membranes; and should the paralysis have been of a slow and progressive nature, the probabilities are that it is the consequence of some chronic softening of the cord; for all these different results have followed local and diffused injuries to the spine, and it is the knowledge that they may take place that renders any spinal injury an accident of importance both from the immediate effects of the injury and its secondary consequences. In rare instances symptoms similar to tetanus follow spinal injury. I have seen it in two cases. One was that of a man, æt. 35, who fell from a height upon his head, bending the neck forwards. He was paralyzed for a few hours from the neck downwards, and on the appearance of reaction he had marked tetanic symptoms with the contracted brow and risus sardonius. Spasms could be excited on the slightest touch being made on his neck. In twelve hours all these symptoms disappeared, and a good recovery ensued.

In the second case a man received a crush in the loins, between two carts. Lockjaw followed, with general spasms of all the muscles of the body. In five hours the spasms subsided, but they were followed for five days by hyperæsthesia of the integument, and on the sixth day by weakness of one leg. In a month he was convalescent.

There is consequently some analogy between head and spinal injuries: a sound knowledge of the one class facilitating a clear understanding of the other.

In former chapters it has been shown that the functions of the brain may for a time be interfered with or suspended by a simple shake or concussion of its substance; that a severe concussion may give rise to contusion of the brain, both at the seat of injury or on the opposite side, by contre-coup; that extravasation of blood may follow such an injury, either upon the surface of the brain or within its structure; that fractures of the skull are of importance in proportion to the severity of the intracranial complications; and that intracephalic inflammation is too frequently the result of any such injury. In injuries to the spine and its contents very similar results have to be recorded. A *simple concussion* of the spine may produce a partial or complete suspension of the functions of the cord; by rest and quiet these symptoms may disappear, and a perfect recovery take place. A *more severe concussion* may give rise to some injury of the nervous structure; to some extravasation of blood upon or into the cord itself. Such a complication will necessarily be associated with more marked symptoms, more complete and persistent paralysis and anæsthesia of that portion of the body supplied with nerves from the injured centre; the completeness and persistency of the paralysis and anæsthesia depending upon the severity of

the mischief and seat of injury. When the paralysis is severe but *incomplete*, there will be retention of urine, this symptom arising from the loss of voluntary power over the muscles that regulate micturition. But when the paralysis and anæsthesia are *complete*, there will be absolute paralysis of the bladder and all its muscles, with incontinence of urine. But this incontinence must not be confused with the dribbling of an over-distended viscus from retention, such as occasionally occurs in the less severe cases.

When the injury is in the cervical region, one or both arms may be more or less paralyzed; when in the lower dorsal, one or both legs; but, as a rule, the paralysis is symmetrical; the symptoms will depend upon the nerves that are involved. The loss of sensation is also generally complete. In one case, however, there may be paralysis of one limb and loss of sensation in the other; in a second, exalted sensibility with paralysis. In one the power of motion may be regained while that of sensation remains lost, and in another the reverse; indeed, on these points there is every possible variety, the seat of injury clearly determining the nature of the paralysis, and pathological observation being necessary to clear them up. Brown-Séquard's observations and experiments on the decussation of the motor and sensory fibres of the cord help the surgeon to explain many of these points. Erichsen asserts that a severe blow upon the upper cervical region may produce instantaneous death from concussion. That when the *vagus* nerve is affected, a sense of suffocation, with irregular action of the heart, or constant vomiting, may be produced. When the *spinal accessory* is affected, that spasm of the trapezius or sterno-mastoid muscles takes place, and that irritation of the *phrenic nerve* causes hiccup and the sensation of an iron band constriction round the body. When the injury is in the lumbar region, the paralysis is always partial, the cord terminating at the second lumbar vertebra.

The *temperature* of the paralyzed limb is always lower than the rest of the body, even when to the patient it may feel hot or burning.

The *prognosis* in any case of concussion of the spine depends entirely upon the changes that are produced in the cord by the injury; and these are fairly to be measured by the severity of the symptoms and their *persistence*. This latter guide is a very reliable one, the persistency of symptoms being generally indicative of organic change. Again, when organic change has taken place the greater is the probability of some secondary inflammatory action in the injured part, and on this the prospects of the case hinge; for in injuries to the spinal cord or membranes, as in injuries to the brain, this intracephalic or intraspinal inflammation is the cause of danger or of death in every case that survives the immediate effects of the accident, and it leaves, even when life is spared, more or less complete paralysis of the parts below the seat of injury.

TREATMENT.—In all cases of concussion of the spine, simple or severe, *absolute rest* in the horizontal posture is most essential. In mild cases this is probably the only treatment that will be called for, the symptoms gradually disappearing, and health becoming restored. The surgeon must, however, enforce quiet for some days after the disappearance of all symptoms for until some ten or fourteen days have elapsed after an apparent recovery, even in the mildest cases, there is danger of intraspinal inflammation. In proportion to the severity of the symptoms is the period of rest after the accident to be enforced. The *prone* position in more severe cases is generally to be preferred to the supine, but the best guide to the surgeon in this matter is the ease the patient experiences. When severe local pain is present, relief is often given by the application of a dry cupping-glass on either side of the painful part, and this operation may be repeated. In

exceptional cases the local abstraction of blood may be found of benefit. The ice-bag is a powerful remedy for good when there is much effusion of blood or pain in the part, and when the symptoms of reaction are too marked; under these circumstances, the administration of some mercurial, such as gray powder, in three or four grain doses twice a day, with Dover's powder, is a favorite remedy with some surgeons; or small doses of the bichloride of mercury, as one-sixteenth of a grain. Counter-irritation by blisters may also be indicated. This treatment is, however, more applicable in cases of chronic intraspinal inflammation, to which attention will be directed in another chapter. The bowels should be regulated, and the state of the urine looked to, great care being observed not to allow the bladder to become distended or injured by catheterism. The elastic catheter is probably the best instrument to use under these circumstances, or the French vulcanite one without the stylet. The diet should be nutritious, but unstimulating, and nothing likely to keep up or cause mental or physical excitement allowed; sleep must be procured by sedatives, such as chloral in half drachm doses, or opium in grain doses. When recovery of power over the limbs is slow, and no symptoms of secondary inflammation of the cord exist, convalescence is promoted by the application of electricity in any of its forms to the enfeebled muscles.

CHAPTER XVI.

INTRASPINAL INFLAMMATION.—SPINAL PARALYSIS AFTER CONCUSSION. RAILWAY CONCUSSION.

"EVERY injury of the spine should be considered as deserving of minute attention. Inflammation of the cord and its membranes may supervene upon very slight injuries of the spine; it may advance in a very insidious manner, even after injuries that were of so slight a kind that they attracted at the time little or no attention."

Thus wrote Abercrombie in 1829, and his observations are as true now as they were then. Upon such facts the whole treatment of injuries to the spine, simple or severe, ought always to be based.

The preventive treatment of spinal as of head injuries, means the adoption of such measures as experience has proved are most valuable in warding off the accession of intraspinal and intracephalic inflammation, and thus preventing paralysis. The simplest shock or concussion of the spinal cord; the slightest blow upon the spine or sprain of its ligaments; any bruising of the former or laceration of the latter; and, much more, any severer lesion, is prone to be followed by an acute or chronic intraspinal inflammation and changes in the structure of the cord that may give rise to paralysis, partial or complete. The surgeon has, moreover, no guide by which to measure the danger or calculate the probabilities of the occurrence of this secondary inflammation. It may follow a slight accident, and fail to follow a severe one, although, in a general way, the prospects of its appearance and its danger depend much upon the gravity of the injury.

When the cord has been much contused or crushed by a fractured or dislocated vertebra, the paralysis that necessarily follows such a lesion is not likely to be aggravated by any secondary inflammatory changes in the

injured cord. These changes may hasten the end of the case, but cannot materially aggravate it. Under such circumstances, the complication is not of such a nature as to add to the surgeon's anxiety. But in less severe examples of injury, in which the primary symptoms do not in any way indicate any organic lesion beyond that which manifests its presence by some temporary suspension of the functions of the cord, it becomes a matter of primary importance for the surgeon to recognize the very earliest indication of inflammatory action, in order that it may be arrested. And as it has been shown that the chief aim of the surgeon in the treatment of all these injuries is to prevent the occurrence of inflammation, so the second is to arrest its progress as soon as it has appeared. For when it has become thoroughly established, neither medical nor surgical art has much power in checking its progress or in correcting its effects; the delicate structure of the spinal centres appearing to be incapable of undergoing material repair when softened by disease or crushed by accident. The cord structure when once destroyed is never replaced, repair taking place only by means of a fibrous change. Paralysis or loss of function, under these circumstances, is permanent. In any case, therefore, of spinal injury, when the symptoms are persistent or steadily progress for the worse; when after their disappearance—partial or complete—they reappear as before or in some altered form, after an interval perhaps of three or four or more days; when local pain is aggravated, movement of the back is difficult or distressing; when nerve pain appears in the course of the nerve-trunks emanating from the injured spinal centre; when muscular spasm or muscular paralysis appears; and constitutional disturbance or general febrility; when any or all of these symptoms, few or many, are found to follow any injury after the first effects of the accident have passed away, the diagnosis of secondary inflammation may fairly be made, and action taken upon it.

In general concussions of the spine, more particularly in railway accidents, when by some general shaking of the body the spinal, cerebral, sympathetic, and circulatory systems are all more or less involved, there is an undoubted disposition for a chronic inflammatory change of a most insidious and creeping kind to take place. The symptoms of secondary action are as obscure as are the primary that follow the accident.

The primary spinal symptoms, it is now well known, are often so mixed up with the general ones, that they are really masked; and beyond a general and temporary loss of power and consciousness there are often no special symptoms by which spinal mischief is manifested. After recovering from the shock of the accident and the mental disturbance the sufferer often feels no definite injury, no local symptoms; and it is not till the lapse of time—the duration of which is uncertain also—that any special symptoms make their appearance.

These symptoms are, again, as were their antecedents, vague and indefinite. The patient, it will probably be found, has never been himself since the accident. He has been unable to work, mentally or physically, with the same force or energy that he did before. He has been irritable in his manner, and perhaps feeble in his powers. Sleeplessness has been more complete or common than it was before, and headache, with general malaise, now often exists.

Some slight unsteadiness of gait is often the first observed symptom, some weight of the limbs, some abnormal sensation, such as that of pins and needles, numbness along the course of a nerve, cramps, perhaps retention of urine, some evidence, in fact, of want of control or want of power over the muscular apparatus, more marked in the lower extremities than

in any, but even in the arms it will manifest itself in its own way. The centres of sensation will, at the same time, show indications of disturbance, either by a state of lessened sensibility, or perhaps by a hyperæsthetic, or some other abnormal sensory condition. By symptoms such as these the attention of the surgeon is probably arrested, and by them the case is to be interpreted. Others, also, will be made out on examination, either at the time or later. On testing the muscular apparatus thoroughly, it will probably be found that the patient will be unable to stand steadily on one leg, or, what is a better test, if he puts his heels together he will totter on making the attempt to raise his body on his toes. When asked to stoop to pick up anything from the ground, he will probably bend his knees rather than his back; and he will walk with a rigid spine. On giving him a small object, as a pin, to take, he will take it clumsily, and with tremor. He will fumble at most things, as he will stumble at anything that comes in his way.

On examining the spine some tenderness may be felt on firm pressure, and this will probably be in parts only. Percussion is hardly a fair test when made direct upon the bones; when employed, it should be indirect, through the fingers. At times pressure applied to the spine causes severe pain, as does any movement, this latter symptom causing the rigidity of the spine to which attention has been directed.

The brain and the organs of special sense may likewise be affected, either by over or under sensibility. *Vision* may be imperfect either in one eye or in both; *hearing* may be over-sensitive or defective; *taste* and *touch* may be perverted or lost; and *smell* is at times destroyed or morbid. In fact, the whole nervous system, cerebral and spinal, may be disturbed, and its functions more or less damaged.

The progress of the disease is most uncertain, and cannot be estimated. When the motor power has been lost from spinal mischief, the best test is galvanism. A healthy muscle supplied from a healthy nerve centre will always contract on the application of the galvanic current. When the nerve centre is so diseased as to cause paralysis, the galvanic current produces no movement—no contraction. This test is beyond the patient's control, and cannot be resisted; it is therefore a very valuable one.

In interpreting these symptoms, more particularly in a railway case, or in any in which the question of damages is involved, it is most important for the surgeon to separate the symptoms of which the patient complains—the *subjective*, from those he can himself perceive—the *objective*. Let him doubt and cross-examine upon each of the former in every way to test their accuracy. He may rely upon the latter, and any positive opinion ought to be based upon them alone. There always hangs a film of suspicion over the former class of symptoms, because self-interest points to a supposed advantage by making the worst of them.

All the symptoms, taken as a whole, undoubtedly indicate a chronic or subacute inflammatory change of nerve-tissue, an inflammation of the membranes or of the cord. When they appear as a consequence of a general concussion of the spine the cord is probably the seat of mischief, its delicate structure being more liable to injury—and consequently to secondary changes—than the tougher membranes. When they follow some local injury, some twist, blow, or forcible bending of the back with laceration of ligaments, it is probable the disease in the cord is secondary to disease in the membranes, the inflammation of the latter being due to the extension of inflammatory action from the injured part inwards. "Inflammation of the membranes of the cord, as of the brain, is a disease not idiopathic, but proceeding from some cause without" (Wilks). But wher-

ever this commences it is a progressive one, and in the end involves all the tissue in its destructive changes.

The pathological changes themselves are tolerably definite. In the cord they put on the appearance of red softening in recent disease, of white in chronic. The parts are soft and pulpy, and microscopically contain granule-corpuscles and elements of the inflammatory process. At times the white matter of the cord will appear to be sound, when the gray substance is soft. The disease may be local or more general. In concussion the latter is the more common condition. When it is in the cervical region death is rapid, when in the lower dorsal life may be prolonged for some time. This fact is well illustrated in fracture and dislocation of the spine.

TREATMENT.—In the treatment of all cases of concussion of the spine, it has been already stated that rest in the horizontal position is the most essential point of practice to be observed; and it is a question how far those obscure examples of spinal paralysis and other symptoms after railway accidents are due to the non-observance of this rule. It is true that in the majority of cases there are no definite indications of spinal concussion after the accident; but the nature of the accident itself is a sufficient guide to the case. A general shaking of the body means a general concussion of the spine with every other part, and the nerve centres by reason of their structure are most liable to injury. It would be well, therefore, to keep all patients who have been the subjects of such injuries quiet and in repose for several weeks after the accident. By doing this, doubtless, much mischief would be avoided.

When symptoms of traumatic intraspinal inflammation have appeared, rest is essential. When local pain is present cupping is of great use, and at a later period counter-irritation by means of blisters. Some surgeons advocate moxas or setons; of the two the moxa is, perhaps, the preferable form. Mercury in one of its forms appears to be a valuable remedy, and the perchloride is, perhaps, the best preparation, given in doses of 1-16th of a grain two or three times a day, combined with bark, quinine, or some other vegetable bitter, according to the wants of the patient. When mercury is inapplicable the iodide of potassium should be substituted. Sedatives should be allowed to procure sleep, and the hydrate of chloral seems to be the best, in twenty or thirty grain doses, at bedtime. Should pain be constant, fifteen grains of the same drug may be given twice a day, a double dose being allowed at night. Belladonna in one-third of a grain or half-grain doses is likewise a valuable sedative. Strychnine is a dangerous drug in spinal disease, at least in progressive spinal disease; it is a distinct stimulant to the spinal centres, and is, consequently, most injurious as long as any progressive inflammatory action exists; when only the effects of the disease remain and all inflammation has ceased to manifest its presence, strychnine may be given. Should general feebleness exist, iron may be given with it; and I know of no nervine tonic so good as the combination of the tincture of the perchloride of iron in doses of fifteen minims, with five minims of the tincture of nux vomica or one or two grains of quinine. Cod-liver oil is a valuable adjunct to all treatment in this as in many other cases.

Great care should be observed throughout the treatment of these affections to prevent the occurrence of a bed sore. They form very rapidly when spinal paralysis is present. I have seen several instances in which all the soft parts over the bones sloughed, and the spinal canal was opened; in others the sacral bone may partially exfoliate. The back should be kept very clean and dry and sponged occasionally with spirit lotion; it should

also be protected by strapping, the felt plaster being the best, and by good cushions of air or water.

When retention of urine complicates the case, the utmost caution is required in passing the catheter. An elastic instrument should be preferred and of a large size. The French vulcanite catheter is, however, the best.

CHAPTER XVII.

FRACTURES AND DISLOCATIONS OF THE SPINE.—WOUNDS AND SPRAINS.

In a practical point of view it is expedient to consider fractures and dislocations of the spine together; they are not, however, invariably combined, for although in four-fifths of the injuries to the spinal column involving the bones some fracture is present, in the remaining one-fifth simple dislocation exists. The majority of these cases of pure dislocation occurs in the cervical region; in the dorsal such a thing is almost impossible, and in the lumbar it is very rare. The difference in the anatomical arrangement of these divisions of the column affords an explanation of these facts. To the practical surgeon these points are, however, of small importance; what concerns him most in any injury to the spine has reference to the cord—how much injury has it sustained? Is it reparable or irreparable?

When complete paralysis follows the injury there is little doubt that the cord has been injured. It may be that it has been more or less completely crushed by displaced bone, or even divided. In less severe injuries less severe symptoms show themselves. Injuries to the cervical region are of greater danger than those of the dorsal, and these again are of more importance than those of the lumbar. The nearer the injury is to the respiratory centre, the greater is the danger. Any crushing of the cord above the third cervical vertebra is, as a rule, followed by instant death; this point being above the origin of the chief respiratory nerve, the phrenic. In cases of injury to the cervical vertebræ giving rise to any symptoms of paralysis, death generally takes place within three days, and commonly within two. Thus, out of 36 fatal cases extracted for me by Mr. Rendle from the Guy's Records, 25 died in less than seventy-two hours, and 20 of them in less than forty-eight; 8 cases only survived the former period, and in those there were no symptoms of paralysis as an immediate result of the accident. 11 of the 36 were cases of pure dislocation, and 25 were examples of fracture and dislocation combined, and all were below the third cervical vertebra; in every case, also, of dislocation the upper vertebra was thrown forwards upon the lower, as seen in Fig. 20. Where spinal symptoms resulted the cord was more or less pressed upon—in some instances crushed, in others bruised.

Fig. 20.



Guy's Hos. Mus., No. 1033.

Fractures of the dorsal and lumbar regions, associated with displacement, and giving rise to paralysis below the seat of injury, are less speedily fatal than are those of the cervical region.

Fracture of the spine may, however, take place and not be associated

with any paralysis; the spinous processes of any of the vertebræ may be fractured, and give rise to no spinal symptoms; this accident is generally the result of a direct blow. When I was a dresser I saw a case of fracture of the spinous processes of three cervical vertebræ associated with a temporary paralysis, from which complete recovery ensued; and I have since treated successfully a case of fracture and displacement of the spinous process of the fourth cervical vertebra without paralysis.

In other cases fracture of the spine may take place and not be detected until after death. Examples of this are not uncommon. In such the cord is not involved, nor any of the nerve-trunks. The following case well illustrates these points.

In 1857, a woman, in an attack of mania, was admitted into Guy's under the care of Mr. Cock, for some contusion of the back caused by a fall out of a window. Beyond the contusion no injury could be made out. There was no paralysis, but, on the contrary, violent muscular movement, the woman being maniacal. On one occasion she got out of bed and struggled to open a window to throw herself out. She lived sixteen days, and for the last week of her life rested quietly in bed, with her eyes closed; she would only at times rouse herself and speak. After death, atrophy of the brain was found, with general fatty degeneration of the viscera. The last dorsal vertebra and three upper lumbar vertebræ were fractured through the bodies, but not displaced; one or two spinous processes were also fractured. The spinal marrow was uninjured. The fact of there being no displacement of the broken bones, and no injury to the cord, prevented the diagnosis from being made.

I have recently seen a case of fracture of the spinous processes of the last dorsal and the first lumbar vertebræ with lateral displacement, that had been treated for some months previously as a simple contusion of the back. In this case no paralysis existed, or other spinal symptoms.

Fractures and dislocations of the spine are generally the result of *indirect forces*, such as severe falls. A forcible bending forwards of the cervical spine may cause dislocation of the cervical vertebræ, and a similar accident to the dorsal spine may cause fracture; and in these cases there is always some laceration of the ligaments and crushing of the anterior edges of the bodies of the vertebræ (*vide* Fig. 21). A forcible bending backwards of the spine may produce a like result, the laminae of the dorsal or lumbar vertebræ, under these circumstances, being much broken. Direct violence to the spine in the cervical region may cause dislocation; in the lower vertebræ it generally causes fracture of the spinous processes or laminae. Mr. Holmes has recorded in the "Path. Soc. Trans.," vol. x, an interesting case of displacement of the last dorsal from the first lumbar vertebra, the result of a direct blow, some slight fracture of the processes being present.

Fracture of the sternum is not uncommonly associated with injuries to the spine from the forcible bending forward of the head; it was found in four out of the fifty-six fatal cases that occurred at Guy's.

Of the fifty-six fatal cases of fracture and dislocation of the spine thirty-six were of the cervical region—eleven being examples of pure disloca-

FIG. 21.



Guy's Hosp. Mus., No. 1035²⁵.

tion—eighteen of the dorsal, and two of the lumbar; injuries of the cervical being apparently twice as frequent as those of the dorsal region; their greater mobility and the horizontal aspect of their articular processes favoring dislocation.

In the thirty-six cervical the injury was below the third vertebra in all but three examples. In one of these it involved the second, third, and fourth vertebræ, in another the arch of the atlas, and spinous processes of the second and third, and in the third case the bodies and arches of the third, fourth, and fifth vertebræ.

In the eighteen dorsal, seven were in the upper and eleven in the lower half, the lower cervical and the lower dorsal regions being clearly more liable to injury than the upper.

When the cord was sufficiently injured in the cases of injury to the cervical region to give rise to paralysis, death generally took place within three days, and in the majority of instances within two.

When it occurred as a result of injury to the dorsal region, suppuration of the kidneys, cystitis, or bedsores were the most common causes of death.

Of the eleven cases of pure dislocation of the cervical vertebræ, four were between the fourth and fifth; two between the fifth and sixth; three between the sixth and seventh; and two between the seventh cervical and the first dorsal. In none of these was there the smallest trace of fracture. In six the displacement was so great as to crush the cord. In five there was no displacement and no marked paralysis as a direct result of the injury, although secondary paralysis appeared subsequently from stretching or other injury to the cord.

In injuries to the cervical region, pure dislocation occurs in thirty per cent. of the cases.

Cases of sudden death after a fall from a height upon the vertex are doubtless often due to a fracture or dislocation of the cervical spine. It may be a fracture of the *processus dentatus* of the axis; a laceration of the transverse ligament binding it in position; or a fracture of the atlas allowing the head to slip forward. Dislocation of the occipital bone from the atlas has been described; it is, however, very rare.

Diagnosis.—When a patient has received a severe injury to the spinal column, followed by complete paralysis, there can be little doubt that the cord has been injured, and that a fracture or dislocation, with displacement of the vertebræ, has taken place. When the paralysis is partial, it is probable that the cord has been only partially involved, more or less bruised, or stretched, according to the nature of the accident, the amount of injury to the cord depending entirely upon the extent of the displacement of the injured bones. When no paralysis is present the diagnosis is difficult.

When any inequality or irregularity in the spinous processes is present; any pain in one spot aggravated by pressure; any crepitus on manipulation; any local effusion of blood about the spine; any inability to move the spine or support the body; or early priapism appears; when one or more or all of these symptoms exist, the diagnosis of a fracture or dislocation is tolerably clear; that is, when they follow such an accident as is prone to produce them.

When paralysis of one arm or leg follows a spinal injury, it is possible that it may be caused by some partial displacement of the injured bone; some pressure upon one or more of the nerves that pass outward from the spine; some laceration of a nerve-trunk. When paralysis is incomplete, the motor power is generally more completely lost than that of sensation; indeed, it often happens that there is hyperæsthesia in that portion of the

body that is contiguous with the paralyzed part, the portion of the cord which is above the injured part being over-active. In estimating the seat of injury from the position of the paralysis, it is right to remember that the nerves come off obliquely from the spinal cord and pass downwards, the nerve-trunks leaving the spine one vertebra or two vertebrae lower than the spot whence they are given off; also that the cord terminates at the second lumbar vertebra. Thus, when fracture takes place below the second lumbar vertebra, there may be no paralysis. The patient may be unable to stand or walk wholly or in part, but put him on his back and there will be free movement of his legs. In other cases the nerve-trunks of the cauda equina may be involved.

Prognosis.—The nearer the injury is to the respiratory centre the greater is the danger to life. Thus, in injuries to the cervical spine, causing paralysis above the origin of the phrenic nerve or third cervical, death may be instantaneous, and when below this position, and the respiratory process is maintained only through the diaphragm, life is rarely prolonged beyond the third day, and, as a rule, not beyond the second. Mr. Hilton has, however, recorded in his lectures "On Rest" a case in which a man lived for fourteen years completely paralyzed, from the neck downwards, after a fracture of the cervical vertebrae; and a gentleman, aged twenty-nine, whom I saw with Mr. Roberts, of Southgate, November 25th, 1870, with complete paralysis of the whole body below the fifth cervical, following a fall upon the neck, is still alive, breathing solely by the diaphragm.

When the cord has been injured in the lower dorsal or lumbar region, life may be prolonged for many months, the immediate cause of death being generally some renal or vesical mischief, some bed sore or other complication the direct result of loss of nerve power in the paralyzed parts. The longer these complications are delayed by careful nursing and attention, the longer will life be maintained.

In other cases, again, in which partial paralysis only or none at all is present, as a direct consequence of the injury, inflammatory changes may ensue in the injured part, and, spreading upwards, cause death: the prognosis in such instances will be mainly determined by the seat of the injury and the extent of mischief in the cord.

The lower the seat of injury the better are the prospects of a cure; the less the cord is involved in the mischief the greater are the chances of a recovery.

Thus fractures of the lumbar region are quite capable of a complete cure, and fractures of the lower dorsal are not infrequently recovered from. Injuries to the cervical spine are generally fatal within three days. Injuries to the dorsal, when not proving fatal within the third week, may endure for months, or even years, the duration of life being greatly determined by the warding off of the secondary complications which so usually destroy.

TREATMENT.—The diagnosis of a fracture or dislocation of the spine having been made, the most essential point of practice to be observed is that the part be kept absolutely unmoved; the patient should be examined with the greatest care, and moved with all possible caution, for any motion will necessarily add to the injury the cord has sustained, and increase the danger of the case. Any manipulation, beyond the gentlest, of the injured part, is to be condemned, as being likely to prove hurtful. Extension of the spine may be employed when much deformity exists, or when severe pain is clearly present from nerve pressure, but extreme caution is required in following this practice; it is not to be employed in every instance, but only when local symptoms seem to suggest the probabilities of a successful issue. I have seen several cases in which marked relief was afforded by

this practice, and the records of surgery contain many more. Practiced with discretion, extension of the spine is doubtless a valuable means of treatment.

Absolute repose in the horizontal posture is an essential point of practice to be observed. When the patient is placed upon his back, the parts have a natural disposition to fall into place; this position, therefore, must be maintained. The bed should be firm, yet elastic; a water bed is the best, when it can be obtained; otherwise, a spring mattress or one of horse-hair should be employed; it must be well protected by water-proof cloth, &c., from all contact with urine or fæces.

The condition of the bladder should be looked to from the very first. Retention is sure to be present for a time, and over-distension is most injurious. The utmost care ought to be employed in drawing off the water. A moderate-sized elastic or the French vulcanite catheter should be used; and the operation repeated twice a day, night and morning.

If the urine become offensive, the bladder must be washed out; no syringe should, however, be used. A stream of water should be allowed to run in and out of the bladder through an elastic tube fitted to the top of the catheter, no force being allowed. The application of leeches to the spine, cupping, &c., is seldom called for. The condition of the bowels must be looked to, and enemata are to be preferred rather than purgatives. The greatest care is needed to keep the patient clean, particularly when incontinence exists.

There are no special medicines applicable to these cases. The general health of the patient must be maintained by tonics and simple nutritious food; sedatives should be given to procure rest and relieve pain.

The condition of the back must be daily looked to, for the prevention of bedsores. This is best insured by taking away pressure, as far as possible, or by relieving it by means of soft cushions and pads, the water cushion being the best, and by keeping the parts dry. The application of a soft felt plaster over the sacrum and hips is sometimes of use, as is also the frequent application to the parts of some spirit lotion. Should it be necessary to turn the patient on one or other side, the attendants must be taught to rotate the hips and shoulders at the same time. By great care and attention life may be prolonged, and even a recovery secured.

The Subject of Trephining the spine requires a brief consideration. Cline was the first surgeon to put it into practice, and on his great authority the operation has been repeated, but with no success. The great argument against its use is derived from the fact that in few post-mortem examinations has the condition of parts indicated that the slightest good could have been derived from its performance. When the cord is much injured by the accident the mischief has been done, and no removal of the displaced bone can undo it, or neutralize its evil. If the cord is not injured no operation is called for.

The danger of a fractured or dislocated spine lies in the injury to the cord. This injury to the cord is the result of a stretching or crushing of its substance by the accident. The displacement of the bones is rarely permanent, it is only temporary, and even when it is permanent, no good can accrue to the cord itself by its removal. The portion of the vertebra displaced is generally its body.

One successful instance of trephining is recorded by Dr. Gordon, of Dublin, and in rare and exceptional cases it is possible the operation may be justifiable. To perform it because it may by chance do good is not sound practice. The onus of proving that an operation is likely to be of use always devolves upon the surgeon before it should be undertaken. There

is, however, reason to believe that a cord may at times be only squeezed or pressed upon by effused blood, and under such circumstances relief might be afforded by removing enough bone to take away the pressure, and thus give the cord a chance of recovering itself.

In the case of the young man I saw with Mr. Roberts, of Southgate, such a probability seemed reasonable, and three months after the accident I cut down upon the injured vertebra, and removed the spinous process and lamina of the fourth cervical, exposing the cord. No harm followed the operation, although no immediate good was produced. The wound healed rapidly, and in the course of a few weeks some slight power returned in the muscles of the shoulders, the patient being able to raise the arms from the bed. He has, however, made no further progress; still, the case is an encouraging one.

"The end proposed in an operation of this kind," says Le Gros Clark, "is to remove displaced bone which is supposed to press upon or irritate the cord; but it is most likely to prove abortive from the inaccessibility of the displaced bone. If the cord have been crushed, and the operation have been consequently useless, probably life may thereby be only curtailed, but if the cord be not crushed, it appears to me that the best chance of the patient's recovery is thereby extinguished. Indeed, my conviction is that the operation has been advocated on the erroneous hypothesis that the spinal cord can be compressed without serious disintegration of its texture."

Wounds of the Spinal Cord.—These are very rare in civil life. They may, however, take place as the result of a stab or a gunshot wound. Should the cord be injured, some symptoms of paralysis will appear, corresponding to the part that has been punctured, the extent of the paralysis and its seat fixing the position of the wound.

Sprain of the Back.—The word sprain is a very broad one, and when applied to the back is very vague. It may mean simply a stretching of the muscles or ligaments of the back, or a more complete laceration of the latter, and separation of the spinous processes of the vertebræ with exposure or injury of the cord.

The number of articulations in the spine—nearly eighty—renders such an accident a common one; any twist of the spine, any forcible flexion, may consequently injure some of these joints, and give rise to symptoms. Sprains may, moreover, be followed by acute or chronic joint disease of a serious and insidious nature. When the head is bent violently forward, the muscles and ligaments may be so torn as to give rise to the effusion of blood, swelling, and severe local pain. When the body is flexed with violence not sufficient to give rise to fracture, the same result may take place, and also when a man falls upon his buttocks. In both these cases there may be only external evidence of injury, or there may be evidence of some affection of the cord. Partial paralysis may be present, proving that the cord has been stretched, if not permanently injured. Should the symptoms rapidly or even gradually pass off, no grave mischief has probably taken place. Should they be persistent or obstinate, a less favorable opinion should be formed. When the lumbar region is the part involved, it is not uncommon for hæmaturia to appear; it may be slight and pass away, or more persistent. It is not, however, a very serious symptom, for, as a rule, it disappears gradually, and no evidence exists that organic renal disease is ever the result. Of the many cases I have witnessed, says Le Gros Clark, I have never had reason to suspect that nephritis or organic disease followed. "*Brit. Med. Journ.*," Oct. 3d, 1868. Mr. Shaw, in "*Holmes's Surgery*," gives a case where the bleeding lasted for four days, ceased for two, and then reappeared in all its severity. After two more days it again

ceased for twenty-four hours, to reappear for a third time in quantity, when it stopped, and a good recovery ensued. When the kidneys are diseased, this symptom is more likely to appear after injury, and also when calculi exist in the kidney.

Hemorrhage may take place into the spinal canal, as the result of a sprain or laceration of the ligaments, some of the large veins that surround the cord probably giving way. Mr. Hewett has related a case of sudden death from a fall upon the head, which Dr. Deville recorded in 1843 ("Mém. de la Soc. de Chirurg. de Paris," t. iii), in which no other injury was found to the nervous centres than hemorrhage into the canal in its whole length. Mr. Le Gros Clark has recorded a second, in which a man was struck violently on the back, but there were no immediate spinal symptoms. Paraplegia soon followed, extending upwards and destroying life by asphyxia. The theca was found distended with fluid blood, derived from a ruptured spinal artery. He gives also another case, somewhat similar in symptoms, though not in result, the patient recovering after two years.

TREATMENT.—In all these cases of sprain, slight or severe, rest is essential, the patient being allowed to assume the position in which he finds the greatest ease. The application of ice in a bag is also of great value where much swelling or pain exists. In other cases a warm poppy fomentation gives relief, or a mixture of belladonna and opium rubbed down with glycerin and applied on lint. When spinal symptoms are present the greatest caution is needed, and the case must be treated as one of concussion of the cord.

Preventive treatment is all-important, to ward off secondary inflammatory changes, both of the spine and cord.

Rest in the horizontal position for seven or eight weeks is an essential point of practice to be observed in all severe cases, and, even in the milder forms, exercise must be sanctioned with caution.

When hæmaturia occurs it requires no special treatment, except when severe. Gallic acid, in gr. v or gr. x doses two or three times a day, may then be given, but, as a rule, this is not needed.

CHAPTER XVIII.

CURVATURE OF THE SPINE.

THERE are two forms of curvature of the spine, the *lateral* and the *angular*. The *lateral* is due to a relaxation of the ligaments and muscles of the spine which in a healthy subject maintain the bony column in its normal position. The *angular* is caused by organic disease of one or more of the bodies of the vertebræ, or of the intervertebral substances. It is generally known as "Pott's curvature."

Lateral Curvature.—This is by far the more common of the two. It is generally found in girls between ten and twenty years of age; sometimes in young children, and it is frequently, but not always, associated with some want of power. It is more common in the middle and higher classes of society, where sedentary occupations and luxurious enervating habits too often exist, than in young women who have full use of all their muscles and lead an active life.

It is encouraged by any one-sided posture of the body, whether this be the result of some faulty habit or occupation ; of overuse of one limb, or of any disease or deformity of a lower extremity which occasions shortening.

In its early stage it is seldom discovered, and attention is, as a rule, drawn to the disease by some "growing out" of one shoulder, generally the right, some distortion of the chest, or some tilting upwards of a hip. These deformities are frequently first noticed by dancing or drill masters. When a curve has taken place in the upper dorsal region of the spine to the right side, a compensatory curve is certain to be found in the lumbar to the left. In investigating a case it is important to bear this fact in mind, for the consecutive or compensatory curve, unless of long standing, will soon be remedied when the original one has been cured.

In some subjects there exists an exaggeration of the natural curves of the back ; when it is in the upper dorsal region and backwards it is called *cyphosis*, when in the lumbar and forwards *lordosis*. This latter curve is very frequently found accompanied with hip disease, and is compensatory ; it is also present in organic disease of the spine, and in *rickets*.

Associated with the lateral curvatures there is usually some rotation of the spine. The amount of this is very variable, and depends upon the extent of the curvature ; it is, doubtless, due to the forcible bending of the bones downwards with the ribs, these latter helping to rotate the vertebræ upon their axes. The bones may be so twisted that their transverse processes project backwards, carrying the ribs with them, the anterior surfaces of the bodies of the vertebræ looking towards the convexity of the curve, and the spinous processes laterally towards the concavity. The thorax is thus much distorted, the side corresponding to the curve being expanded, and the opposite one greatly contracted. This is well seen in the annexed drawings, Fig. 23 taken from a living patient, and Fig. 22 from a preparation.

FIG. 22.

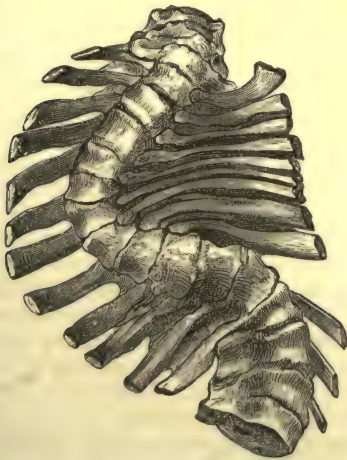
Guy's Hosp. Mus., No. 1006⁶⁰. Anterior view.

FIG. 23.

Taken from Emma J., æt. 14.
Posterior view.

The *diagnosis* is not very difficult when the deformity is well developed. The double curve giving the spine a sigmoid form marks its nature. In less severe examples this curve can readily be removed by extension of the

body, or by lifting the patient from the ground by a hand in each axilla. In the severer forms, such as that illustrated in the drawing, the deformity is permanent. The ribs are thrown out in an extreme degree, pushing the scapula outwards and upwards, and the lumbar curve is very characteristic. The whole thorax, abdomen, and pelvis are altered in shape and position by the deformity.

TREATMENT.—The cause of the deformity is the first point the surgeon should look for; it is rarely to be found in the spine itself; it is, in the majority of cases, remote. When found, the main object of the surgeon is its removal. Should general debility be the cause, the whole frame will be equally involved. Good air, good food, and tonics are three essentials, and with these much may be done by local treatment.

The feeble muscles and weakened ligaments are to have rest; they are to be kept in health by moderate exercise, but are never to be fatigued; should fatigue be experienced by walking one hour, such exercise must be curtailed to a shorter period. Should backache be produced by exertion, less must be taken. Exercise is to be allowed, but is always to be kept short of fatigue. Sitting and standing are not to be sanctioned. The patient should recline at stated intervals in any position that gives the greatest ease. When the deformity is definite, and the dorsal curve is to the right side, as is nearly always the case, he should rest upon that side with a pillow beneath the right arm; the weight of the body then acts as an extending force upon the curved spine, and thus tends to reduce the curve. By adopting this practice two or three times in the day for a definite period, depending upon the nature and severity of the affection, much good may be obtained, and very severe curvatures remedied. Cold sponge or shower baths, as they can be borne, are always good, and a moderately firm bed: a spring mattress is better than a feather bed. Gentle calisthenic exercises are valuable adjuncts to treatment when practiced with discretion; but it is to be remembered that a weak spine is being dealt with, and anything like violence may be most detrimental.

The objects of treatment are, therefore—1. To improve the general condition of the body. 2. To give rest to the strained and weakened muscles and ligaments. 3. To strengthen the muscles that support the spine by exercise, which must be carefully regulated to prevent fatigue. 4. To restore the spine to its normal direction by posture, and by pressure applied in the horizontal position.

Mechanical contrivances have been much vaunted, and are much employed. I confess, however, to having little faith in their value as *curative agents*. They tend to cause atrophy of the muscles that support the back, instead of strengthening them, and thus to make the deformity a permanent one. In bad and exceptional cases they may be employed when the treatment that has been sketched out cannot be borne or is inapplicable. The general supports, as made by Bigg, Millikin, and others, are then of use. When the deformity is irremediable and support is essential to allow the patient to get about, such instruments are of value; but as curative agents no apparatus is to be recommended.

Should the curvature have been encouraged by any faulty habit, such as standing on one leg, or in one position, or the use of one arm, it is needless to say that the habit should be discontinued.

It is probable that the deformity is greatly due to a compressed condition of the intervertebral substance, it being well known that this material is capable of being compressed one-fourth of its thickness; thus a man by maintaining the erect posture during the day, will be an inch shorter at night than when he rose in the morning. When unequal compression is, therefore, kept up, the deformity produced by it becomes permanent, and the growing

bones necessarily assume shapes and positions corresponding to the deformity, and tending to increase it.

Angular Curvature of the Spine.—This, which is generally known as Pott's curvature, is due to a destructive inflammatory change of the bodies of the vertebræ and intervertebral substances. It usually begins in the latter position, although the bone itself may be its primary seat. It is at times associated with tubercular deposit in the tissue, but there is no evidence to prove that it is always due to the presence of tubercle. It is an inflammatory local affection of a low type, and is often accompanied with extensive local change. The curvature is directly due to the destruction of the bodies of the vertebræ and the intervening intervertebral substance, the upper vertebra falling down towards the lower, and joining with it. When the bodies of many of the vertebræ are involved the deformity will be severe; a preparation in Guy's Museum (1006⁵⁰) shows this; the bodies of twelve vertebræ were implicated, but a cure resulted. It is rare to find the cord involved in the disease; the most destructive changes may take place in the bones and great deformity, even to an acute bending of the cord, without giving rise to any disease of it. These points are well seen in the drawing. It may occur at any period of life, but it is the more

FIG. 24.



Angular curvature of the spine, the same as that illustrated in the former figure, taken from a patient æt. 35.

prone to appear during the growth and development of the spine; it is, consequently, more frequently found in childhood. From a remarkable preparation in the Guy's Hosp. Mus. (1004⁹²), it would seem that it may attack the fœtus in utero, the bodies of three or four of the dorsal vertebræ being clearly fused together from disease, giving rise to angular curvature.

When a cure takes place it is generally by ankylosis; but occasionally the parts are held together simply by fibre tissue.

The disease more commonly attacks the lower dorsal region of the spine than any other, although the cervical and lumbar regions are not seldom implicated. In rare cases it is double. It may run through its whole course, even to a cure, without giving rise to any external suppuration; more commonly, however, an abscess makes its appearance. *Spinal abscess.* Pus will sometimes find its way from the dorsal region beneath the fascia covering in the psoas muscle under Poupart's ligament, and appear as a

swelling in the groin at its inner half (*psoas abscess*). This swelling may burrow downwards, involving the whole thigh in one large abscess. When the disease is in the lumbar region pus may burrow between the dense layers of fascia and tendon, binding in the quadratus lumborum muscle, and appear in the front of the abdomen, above Poupart's ligament, or in the loin (*lumbar abscess*). In other cases it will make its way under the fascia, covering in the iliacus muscle, and appear beneath Poupart's ligament, but at its outer half. In other instances, again, the matter will find a passage downwards into the pelvis, and either make its way through the sciatic notch into the gluteal region (*gluteal abscess*), or pass downwards behind the trochanter major to the thigh. In still rarer cases the pus appears by the side of the rectum.

When the cervical region is the seat of the disease suppuration may appear in the pharynx as a *pharyngeal abscess*, or externally in the neck behind the sterno-cleido-mastoid muscle. The following case is a good example of this:

A boy, æt. 3, was brought to me at Guy's, in 1862, for some affection of his upper cervical vertebræ, following a fall down stairs upon his head. An abscess formed, two months after the accident, behind the left sterno-cleido-mastoid muscle, from which a piece of the lamina of a vertebra escaped six months afterwards. He kept his bed for upwards of one year, when he got up with a stiff neck; he was unable to nod or rotate the head, clearly showing that the joints between the occipital bone and the first two vertebræ had been diseased and had ankylosed. In 1867 this boy came under my notice again. His head was quite fixed; the cervical vertebræ seemed shorter than usual, but no irregularity existed.

The drawings below, taken from Ellen T—, æt. 14, a patient of Mr. Poland's, illustrate a case of severe cervical disease with lateral deformity.

FIG. 25.



FIG. 26.



FIG. 27.



In this patient a good result was obtained by means of the apparatus depicted in Fig. 27, the cure resulting in ankylosis. Suppuration, however, does not always take place. A woman, æt. 30, came under my care in 1859 for a stiffness of her head and neck, that had been increasing for two years; she had looked upon it as rheumatic. When I saw her the head was immovably fixed, and slightly rotated to the right side. Rotation and nodding were impossible. There was much thickening about the cervical vertebræ; pains darted upwards to the vertex and downwards to the shoulder. By rest in bed, fomentations, and tonics, all these pains disappeared, and recovery ensued, but with a stiff neck.

From any of these abscesses bone may exfoliate; it may be coughed up from the pharynx, or exfoliate from the neck. I have seen a mass the size of a nut come away from a lumbar abscess, and a piece of bone, clearly

spinal, discharged from an abscess of the thigh, opening above the knee-joint. In a case recently brought under my notice by a valued dresser, Mr. Burgess, the anterior half of the atlas, with its articular facets, was expectorated, a recovery ensuing; and in the Guy's Hosp. Museum there is a preparation of the odontoid process similarly got rid of. In fact, from all these *spinal abscesses* bone may be discharged, and, what is more, recovery take place.

Diagnosis.—When any acute angular curvature of the spine exists there can be no difficulty in recognizing the nature of the disease, nor in reading the process by which the curvature has been brought about. When a large abscess coexists with the deformity there is good reason to suspect that the one is the direct result of the other, more particularly when the suppuration can be traced up to the spinal deformity. The difficulty of diagnosis is felt in the early stage of the disease, before any local change has taken place, and it is here that great care is needed, for if any decided good is to be gained by treatment it is at this early period. What, then, are the indications which denote the presence of spinal disease? *Local and persistent pain* in one spot is probably the earliest, and when this is accompanied by *local tenderness* on firm pressure the surgeon's suspicion should be excited. When with these symptoms the patient exhibits a *rigidity of the spine* in walking or moving, when, on being told to pick up anything from the ground, *he bends his knees in preference to bending his back*, the diagnosis becomes more certain.

When pain is detected in the course of any of the nerves coming from the seat of the affection; when the patient complains of any sudden jar of the back by a slip down stairs or any jump; when any constitutional disturbance is present, such as a quick pulse, occasional febrility, and a furred tongue; when all these symptoms, or many in combination exist during that period of life when bones are growing, and bone disease is prone to appear, the surgeon should always suspect disease of some portion of the spine, and until he can satisfy himself that none such exists, it is a wise plan to treat the case as if it were present. It is true that, by adopting this rule of practice, he will be occasionally misled. He will at times treat a case of hysteria as one of spinal disease; but what harm? He will probably do good to the hysterical patient by the treatment he would adopt for the spinal complaint, while he would certainly do much harm to the latter by neglecting such measures as are essential for its successful treatment.

TREATMENT.—It is an interesting clinical fact that the best cases of recovery from the worst examples of spinal curvature and disease are to be found amongst that miserable class of patients who have never had any chance of receiving proper treatment; who have never had rest or any care; in whom the disease has run its course untended and uncared for, and yet in whom a cure has taken place with firm ankylosis, although with deformity. The majority of these cases are examples of disease of the dorsal vertebrae. How far this deformity might have been lessened or prevented by proper treatment is an open question. Nevertheless it is a truth that cannot be contradicted, that, in the early stage of this disease, rest in the horizontal posture, rigidly and persistently maintained, is an absolutely essential point of practice to be observed. Not, however, rest upon the back, for in many instances this supine position tends rather to separate parts that ought to be kept in contact; but rest in any position that the patient feels to be most comfortable. Sometimes the prone position is the best. In young children this treatment is the right one to follow.

The general health of the patient must be maintained as well as possible,

by simple nutritious food, stimulants enough to assist digestion, but no more, and tonics, such as iron, quinine, and cod-liver oil.

When pain exists, local fomentations are often a comfort; occasionally the application of a few leeches relieves. Small flying blisters, placed alternately on either side of the painful spot, are sometimes of use, and a plaster of belladonna or opium, rubbed down with glycerin over the part, is a valuable adjunct. When severe nerve pain is present, the hypodermic injection of morphia may be used. Sedatives must be given to procure sleep when it cannot otherwise be obtained. Setons, moxas, and mercury are not to be recommended.

By the adoption of this line of treatment a cure may be obtained. It must, however, be followed out for many months, even for years; the greatest care being taken that the patient does not get up too soon, for a relapse is always a very serious affair. Rest had better be maintained too long than given up too soon.

When the patient does get up, it is essential that an apparatus should be worn to support the trunk. It must rest upon the hips, and the weight of the upper extremities must be supported by it. It must also be a firm and steady support to the deformed and weakened spine. This is the best carried out by a leather mould framed on a cast of the back, and adapted to the pelvic crutch and spinal supports. Such an apparatus is made by Millikin, of St. Thomas's Street. I know of no spinal support equal to this in efficiency and comfort. When the disease is in the cervical region, a collar to support the head should be worn for some months after the supposed cure.

Spinal abscesses should not be opened hastily, for they may be absorbed and wither away. When steadily progressing, however, they must be treated, and Lister's method is without doubt the best; a free opening should be made under a piece of lint saturated with carbolic oil or oil. I have, however, in some cases made a free opening into the abscess without any such precautions, and with an equally good result—making it so free that no retained pus remained, and if air got in it got out again as freely. Retained pus and air are sure to decompose, but if a free vent be made for both harm rarely ensues. To allow abscesses to enlarge to any extent without interfering is not good surgery, for the time will come when they will either open naturally or have to be opened, when by their size they become of greater importance.

Disease of the Upper Cervical Vertebrae.—Disease of the upper two cervical vertebrae and of the occipital articulation is often found; it may be accounted for by the greater mobility of the joints, and consequent liability of the ligaments to sprain and laceration. Disease may be situated in the bones entering into the formation of the joints, or in the soft parts binding them together; and with the disease some displacement of one of the vertebrae is occasionally met with. When the disease is in the second vertebrae, the odontoid process may separate and even exfoliate. Such a result took place in a case illustrated in Guy's Museum, prep. 1018¹⁵, in which a woman who had had a stiff neck for months coughed up the necrosed odontoid process; recovery took place with a stiff neck, and four years subsequently the woman was following the occupation of a barmaid.

When the transverse ligament is diseased the odontoid process may become displaced and the cord injured (Guy's Museum, prep. 1289³²). Sudden death may take place under these circumstances, when the displacement is great. When partial more or less paralysis may ensue, this symptom depending upon the amount of pressure the cord has sustained. Fixed pain about the cervical vertebrae, with stiff neck, is always suspicious; and

when aggravated by rotation or downward pressure of the head the case is a serious one. The aspect of the patient under these circumstances is very characteristic. The chin is generally tilted up, and all the muscles of the neck are rigid; the patient may even support the head with his hands.

TREATMENT must be conducted on reasonable principles. The danger of a sudden death by the displacement of the bones must be diminished by the application of a support to keep the head straight and prevent its falling forwards. This is well done by the application of a collar round the neck, passing under the chin with a support embracing the head. Rest in the horizontal position is of great value, as also are other remedies similar to those that have been mentioned in the treatment of angular curvature of the spine.

CHAPTER XIX.

INJURIES AND DISEASES OF THE NERVES.

WHEN a nerve is struck or contused, pain is produced; it may be of a passing tingling character, or of a far more severe kind. Most people are rendered familiar with these facts by an occasional blow upon the ulnar nerve, or what is called the "funny bone." When the blow has been severe the pain may be lasting, and the functions of the nerve so disturbed or interfered with as to give rise to loss of power or sensation in the parts supplied by the injured nerve. A man, *æt.* 29, went to sleep with his elbow resting on a table, and when he awoke there was complete paralysis of the parts supplied by the ulnar nerve, and loss of sensation. When I saw him two days afterwards these symptoms were very marked; there was also tenderness over the nerve behind the inner condyle; to which spot a blister was applied. In two weeks returning sensation appeared, with some slight power of motion; in five weeks he was well. This was clearly a case of paralysis of a nerve from a contusion. A man, *æt.* 46, received a blow upon his ulnar nerve against a chair. No pain appeared at the time, but three hours later pain and numbness showed themselves, and at this time some thickening over the spot could be made out. In the course of three weeks these symptoms disappeared and recovery was complete. In this case it would appear as if some hemorrhage had taken place into the nerve sheath, giving rise to the paralysis, which disappeared as the blood was absorbed.

Wounds of Nerves.—When a nerve is *wounded*, pain is produced. This may be of a passing character or more permanent; in nervous, hysterical subjects the nerve pain is sometimes severe and persistent—it is then called neuralgia. It may be confined to the injured branch of a nerve, or reflected to and back from the spine and involve the whole trunk.

When a nerve is *divided*, complete paralysis of the part supplied by it results; it may, however, reunite and recovery take place. Paget in his "Lectures on Surgical Pathology," 3d ed., has related a case of complete division of the median nerve, in which the trunk had nearly recovered its conducting power a month after the wound. I have seen a like case in which recovery ensued in four months. The following example is another case in point.

A woman, *æt.* 30, came to me with an incised wound behind the inner condyle of the humerus, which had completely divided the ulnar nerve.

There was perfect paralysis of motion and sensation of the parts supplied by it. The edges of the wound were adjusted and the arm was placed in a sling. A month later she came again with a burning pain in the little finger, which was really cold, but red, swollen, shining, and blistered; to the touch some slight sensation was present. Cotton-wool and oiled lint were applied, and the arm was fixed upon a straight splint. The original wound had nearly healed. In two weeks the finger looked natural; sensation in it and all other parts supplied by the nerve had improved. In another month she returned with the old symptoms as bad as ever; they had reappeared upon the removal of the splint two weeks previously; on its reapplication with the cotton-wool they again disappeared. The splint was then kept on for two months, when sensation became natural, complete repair having taken place in four months. When seen six months later she was still well.

The red, swollen, shining, and blistered condition of a finger deprived of nerve force is characteristic; it is generally associated with the sensation of a burning pain and loss of temperature, amounting sometimes to a depression of 9° or 10° Fahr. These symptoms are clearly due to malnutrition. When the nerve repair does not take place, these symptoms are very prone to return from time to time on any change of temperature or depression of the general power of the patient. In complete paralysis of the ulnar nerve, in which atrophy of the muscles supplied by it ensues, the aspect of the hand is very characteristic, the wasting of the interosseous muscles, with the abductor indicis (also an interosseous), and all those of the little finger, giving rise to a peculiar hollowing of the parts between the metacarpal bones which is typical. Nerves, when divided, do not, however, always reunite. When a piece has been removed, either by accident or by design, as in the operation for *tic douloureux*, the restoration of function is very rare, although it may occur.

TREATMENT.—Bruised nerves are to be left alone, natural processes being, as a rule, amply sufficient to effect a cure. When recovery is slow, and associated with pain in the injured part, the application of a small blister is beneficial. When a nerve is divided it is well to put the divided ends as closely in contact as can be done; to place the limb in such a position as will prevent any separation of the divided portion; to keep the paralyzed parts warm with cotton-wool and of an equable temperature, and the whole limb at rest until complete repair has taken place. The application of a suture to a divided nerve is a legitimate proceeding; it is not, however, uniformly successful. When much nerve-pain exists, *bella-donna* or opium rubbed down with glycerin is a nice application, or the hypodermic injection of morphia.

Neuralgia, Tic Douloureux.—This nerve-pain is an affection of middle age, and is due to many causes. It is mostly found in subjects who are morbidly sensitive to external impressions; it may be confined to the distribution of a single nerve, or follow no distinct anatomical course. In point of severity it varies much. At times it is agonizing, at others endurable; sometimes the pain is of brief duration, at others it is more lasting. The fifth pair of nerves is the most common seat of this affection, and a decayed tooth its most frequent cause, the source of irritation being reflected to and from the nerve centre to one or all the branches of the trunk. An instance like this may be taken as a type of the class of cases which originate in some peripheral irritation. Indeed, some local nerve irritation, such as that produced by a decayed tooth, should always be looked for in these cases, although extreme nervous sensibility, hysteria, and want of power, are common concomitants.

When a reflected cause cannot be found, a local one should be looked for—some local inflammation or thickening of the nerve-trunk, some tumor developed in its course, some cancerous growth, some cicatricial tissue—indeed, whenever neuralgic pain exists with a cancerous tumor, or after its removal, the surgeon should suspect the existence of some secondary cancerous deposit in the course of the sensory nerve. When it shows itself as a painful stump, a cicatrix or enlargement of one or more of the nerve-trunks may be suspected. In the following case it was caused by the contraction of a cicatrix:

A man, æt. 41, came under my care in 1866, for severe pain down the anterior and outer portion of his left leg and foot, with almost complete paralysis of the extensor muscles. The symptoms had been coming on gradually for years, and had followed a severe wound, sustained twelve years previously, over the head of the fibula. There was a hard cicatrix over the head of the fibula, which clearly involved the external popliteal nerve. I made two deep vertical incisions on either side of the cicatrix, taking tension off the nerve, and complete relief followed; six weeks later he was still well.

When no local cause can be made out, some general one will probably be present, such as nerve depression or anæmia, some exposure to cold and wet, some malarious influence; under these circumstances the pain will be intermittent or remittent.

TREATMENT.—The treatment of these cases of neuralgia must rest entirely upon their cause. When a local cause can be made out, its removal is the only correct plan—for example, the removal of a tooth, of a tumor, or of a bulbous extremity of a nerve. When hysteria complicates the case, or any uterine disturbance, tonics are suggested, such as iron, zinc, or quinine, and of these full doses may be given. When malaria appears to be the cause, bark or quinine is invaluable. In local neuralgia, more particularly in *sciatica*, the hypodermic injection of morphia in one-third or half-grain doses often acts as a charm. The fluid should be injected in the course of the nerve, and in all forms of neuralgia it is of value. Chloroform, belladonna, and opium, locally applied, is also of use. The general condition of the patient should always be looked to, and the treatment directed to its improvement. Good food, good air, and tonics, are always essentials. Purgatives, where needed, are of value, but they must be regulated so as not to depress. Stimulants are likewise of use, but not in excess. In females the condition of the uterine organs should always be carefully attended to.

In obstinate cases of neuralgia the division of the nerve has been performed with occasional success; it is not, however, an operation for which much can be said in its favor. When the cause of the neuralgia is peripheral it may succeed for a time, but these cases are the very ones in which recovery may be expected on the removal of the cause; and when some central mischief is the source of the pain the operation is not likely to be of use. Nevertheless, in desperate cases the excision of a portion of the offending nerve is a justifiable operation; it has been of use and may be so again. Dr. Fayrer, of Calcutta, has related in the "*Medical Times*" for 1868, a case of *sciatica* in a syphilitic man, æt. 30, in whom swelling was detected in the nerve-sheath, and pain was at once relieved by puncturing the part with a knife.

Neuroma.—Any tumor connected with a nerve is called a neuroma. These neuromata may be of a fibrous or of a fibro-cellular kind, and there is reason to believe that they may have an inflammatory origin. They may be very small, or of larger dimensions, and when large they may con-

tain cysts. Sometimes they are developed within the nerve-sheath; at others they are situated upon it. In a third class the fibrillæ of the nerve-trunk appear to be separated by the new tissue, or to be incorporated with the growth. They are at times single, but more frequently multiple; occasionally they involve nearly every cerebro-spinal nerve in the body. Wilks has recorded such a case in the "Path. Soc. Trans.," vol. x, in which, after death, neuromata were found all over the body, appearing as nodules on some nerves, as distinct tumors on others, the nerves appearing of irregular size and indurated in a third, the fibre tissue being infiltrated among the nerve-fibres. The pneumogastric nerve had a tumor the size of an egg upon it. Dr. Smith, of Dublin, in his unrivalled monograph upon the subject, has recorded an instance in which many hundreds of such tumors existed, and others might be quoted.

These tumors are not, as a rule, painful; indeed, in the most marked examples of this disease, in which the tumors are multiple, they are often not recognized till after death. Pain is, however, sometimes present, aggravated on pressure, and apparently depending much upon the mode in which the nerve is involved. This affection is not to be confounded with the *painful subcutaneous tumor*. When the end of a divided nerve becomes enlarged from fibrinous effusion, and consequently bulbous, what is called a *traumatic neuroma* is formed. When this becomes involved in the cicatrix of a stump it is an exceedingly painful affection; it is thought by some surgeons to be more common after flap amputations than others; it must be remembered, however, that all nerve-trunks become more or less bulbous after amputation.

TREATMENT.—There is no reason why neuromata should be removed or touched, unless they are very large or very painful. When from these causes they require treatment, the operation should be performed, care being observed to dissect the tumor from the nerve, when it is possible; this, however, can rarely be done. Many cases are on record in which large neuromata have been excised with the nerve-trunk, and a good recovery has ensued, even with a restoration of the functions of the divided nerve. Traumatic neuromata should always be excised when causing pain.

Painful Subcutaneous Tumors.—These tumors are clinically to be separated from the neuromata which have just been considered, although they have doubtless often been confused with them. They are not, however, nerve tumors, although *intense painfulness* is their clinical peculiarity. They were first described by Wood, in the "Edinburgh Medical Journal" for 1812. They are usually single and situated in the subcutaneous tissue; they are rarely larger than a small bean. They are encysted, and give to the finger a hard elastic touch. To the eye they appear bright yellowish or of a pearly white. They appear to be made up of fibro-cellular or fibrous tissue. They have no such nerve connection as will explain their excessive sensibility. The pain, says Paget, is of the nature of that morbid state of nerve-force which we call neuralgia.

The painful character of these tumors is very peculiar; it is not constant, nor does it appear to depend upon any injury; it sometimes comes on without any assignable cause, or after only the slightest touch, the pain beginning in the tumor, gradually increasing in intensity and extent till it becomes almost unendurable, darting from the tumor up and down the limb or over the body. The muscles of the limb may likewise be spasmodically affected. The paroxysm may last only a few minutes, or continue for hours; it subsides as it appears, gradually, leaving the parts that were the seat of pain tender. These painful tumors are most frequent in the female, the neuromata in the male.

TREATMENT.—The only treatment is the excision of the growth, and it is generally effectual. These tumors rarely recur, although Paget has recorded one or two examples in which a return took place.

THE SURGERY OF THE RESPIRATORY SYSTEM.

CHAPTER XX.

THE SURGICAL AFFECTIONS OF THE NOSE.

Wounds.—Incised and lacerated wounds of the nose generally do well on account of the freedom of its vascular supply. The edges of any wound should consequently be carefully brought together and fixed with sutures, even if the part be nearly separated from the body. Very fine silk should be used, and great care exercised in the accurate adjustment of the parts. There is no objection to passing a suture through the cartilages when they have been divided. In the case illustrated below the organ was nearly cut off; it was adjusted, and a good recovery ensued; it occurred in the practice of my colleague, Mr. Poland.

Fracture of the Nose.—A blow upon the nose may cause a fracture of the nasal bones; when no displacement is present, little treatment is required beyond the application of cold water dressing, or perhaps ice, for the first few hours, for these bones rapidly reunite.

When displacement has taken place, the surgeon must restore the misplaced bones by external manipulation, aided by pressure applied from within by means of the blades of the ordinary dressing forceps, a probe, or a female catheter introduced into the nasal cavity. When the parts have been restored to their natural position, or as nearly so as the surgeon can succeed in doing, care is to be observed that no external pressure is employed by which they may be displaced. Plugging of the nostrils is a useless practice. Should the force have been severe and direct upon the nose, fracture of the skull may complicate the case—fracture either of the ethmoid bone forming the floor of the base of the skull, or fracture of the frontal bone. The first complication has been illustrated in the chapter on injuries of the skull (Fig. 7). The second is by no means uncommon. It may generally be recognized by the swelling and crepitation of emphysema about the forehead, or the crepitus of the fracture with displacement, &c. Cases of fracture of the frontal sinus require no special treatment. They generally do well.

In children the cartilage of the nose is apt to be displaced off the nasal

FIG. 28.



Drawing 199th, Guy's Hosp. Mus.

bones in consequence of an injury; unless replaced permanent deformity ensues. When this accident takes place, the surgeon should do his best to restore the misplaced parts, and to keep them in apposition, although some difficulty is often experienced in doing this.

Epistaxis, or bleeding at the nose, is an occurrence of some frequency, and when not too free or lasting rarely requires surgical interference. It may be the result of an injury,—*traumatic*—associated with some cancerous affection, some fibrous growth growing from the base of the skull, or other local causes; or it may be the direct consequence of some fulness of the vessels of the head from obstructive affections of the circulation, purpura, hepatic disease, or fever. It is found also in anæmic and cachectic subjects as a kind of *passive* exudation, and may be supplementary to the catamenia.

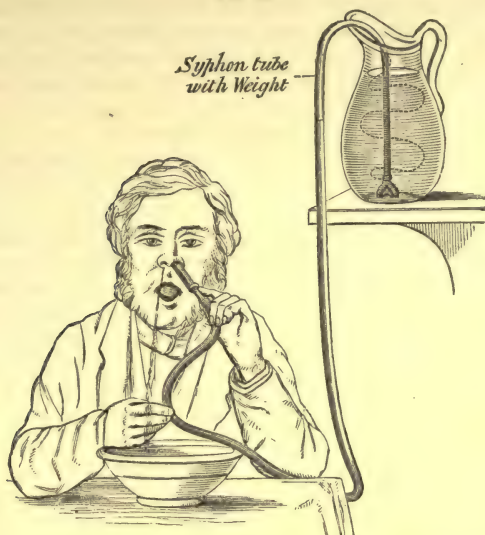
TREATMENT.—For its successful treatment its cause must be made out. When traumatic it usually stops without aid. When due to plethora of the vessels from any cause it is often salutary, and is to be checked only when too copious or lasting. When of a passive nature it is serious, for anæmic feeble subjects cannot bear loss of blood, and the loss tends to aggravate its cause. In one case, therefore, saline purgatives may be of value; in another, iron in full doses, or gallic acid in gr. v or gr. x doses. Indeed, for its treatment no definite rules can be laid down, it being a common associate of so many different conditions, local and general.

When, however, life is threatened by its severity, real or comparative, the surgeon is bound to interfere. The head should be kept raised, and cold applied to the nose and frontal sinus by ice when it can be obtained. Cold to the nape of the neck is also often of use. A steady stream of some cold saline liquid (a teaspoonful of carbonate of soda and common salt to a pint of water being as good as any), passed through the nostril, is a very effectual mode of treatment. Dr. Thudichum's douche is a useful instrument to use. It is composed of an india-rubber tube connected at one end with a receptacle for fluid, and at the other with a perforated nozzle of horn, vulcanite, or glass, the fluid being allowed to flow by hydrostatic pressure through the tube into one nostril and out of the other, the patient breathing at the time through the mouth, which should be kept wide open. Professor Weber, of Halle, discovered, years ago, that, while the patient is breathing through the mouth the soft palate completely closes the posterior nares, and does not permit any fluid to pass into the pharynx. Dr. Rasch's vaginal syphon douche, applied as in Fig. 29, however, answers every purpose, or even the double-action india-rubber enema apparatus. The popular methods of placing the patient in the erect posture, and raising both arms above the head, may likewise be used. They are unquestionably good. Should these measures fail, the nostril or nostrils must be plugged.

To do this effectually some skill is necessary; to do it otherwise is useless, if not injurious. To plug from the anterior nares alone is to trifle with the hemorrhage, it merely masks the escape of blood and directs it down the pharynx, and in this way severe loss of blood may take place without knowledge. To perform the operation of plugging effectually, a plug of lint, cotton-wool, or compressed sponge, an inch and a quarter long and an inch wide, should be prepared and fastened in the middle by a piece of strong silk or whipecord, an end about six or nine inches long being left. With Bellocq's canula (Fig. 30), a long-eyed probe, or an elastic catheter, a double thread of the same strong material should be passed into the nose along its floor, through the posterior nares into the pharynx, and the loop caught either by the fingers or forceps and held

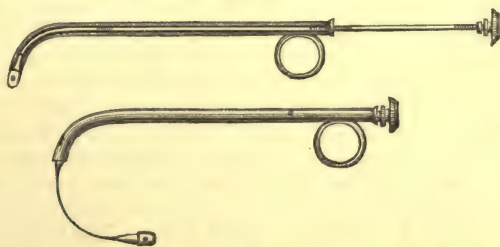
while the instrument is withdrawn through the nostril. There will then be the loop hanging out of the mouth, and the two ends out of the nostril. The loop is then to be fastened firmly to the pledget that has been prepared.

FIG. 29.



This plug having been well oiled, is then to be drawn into the mouth by applying traction upon the ligatures protruding from the nostril, tilted with the finger behind and above the soft palate, and carefully adjusted or wedged into the posterior nares; by this means the escape of blood into

FIG. 30.



the pharynx will be prevented. The two cords hanging from the anterior nares are then to be separated, and the nasal cavity filled with compressed sponge, lint, or cotton-wool, introduced between them, and the whole mass is to be made secure by tying the two cords across the plug that has been introduced in front, fastening them in a bow to allow of unfastening. Should any styptic be deemed necessary, the sponge, cotton-wool, or lint, introduced into the anterior nares, may be saturated with the solution of the perchloride of iron, tannin, matico, or a concentrated solution of alum. In this way the possibility of any escape of blood from either opening into the nose can be effectually prevented, and the most dangerous epistaxis absolutely controlled. To remove the apparatus, the knot at the anterior nares is to be undone and the anterior plug taken out, the posterior being readily drawn from its position by means of the end attached to it in the pharynx; this end, which need not be more than six inches, may be left

hanging down the patient's throat. The plug should not be left in more than three or four days, but may be reintroduced if necessary, the surgeon taking care to preserve *in situ* the two pieces of cord that have been passed along the floor of the nose.

Lipoma, or Hypertrophy of the Nose, is a readily recognizable affection; it is a disease of the skin and subcutaneous tissue (not of the cartilages), in which the follicles freely participate; it is confined to the apex and alæ of the organ. The enlargement is sometimes general, at others the swellings are pendulous, lobulated, and loose. The capillaries of the part are sometimes congested, giving the growth a purplish hue. It is, as a rule, painless, and causes only mechanical annoyance; it interferes at times with vision and the functions of the nose; it moreover wounds the vanity.

Nothing but the removal of the growth can be suggested. This can be done without danger and with no great difficulty. The redundant mass is to be dissected off, care being observed not to encroach upon the nostril. This is best done by introducing the little finger or a spatula into the nostril, and shaving the redundant mass off the cartilage with a sharp scalpel. What bleeding takes place can usually be checked by cold, styptics or torsion; the wound that is left must be allowed to granulate. The surgeon should not, however, take away too much or go too deep; some covering to the cartilages should be left. The disease rarely returns. The late Mr. Hey, of Leeds, was the first to perform this operation.

Lupus Exedens.—This affection is more common on the nose than any other part of the body, and it is often very destructive; indeed, it may destroy the whole organ. It is, however, more amenable to treatment than is usually supposed. It is too often described as a strumous, and consequently constitutional affection, and regarded as incurable. It would be well, however, if surgeons would practically regard it more as a local one. The best local treatment is doubtless cauterization, and the galvano-caustic is far superior to any. Nitric acid, the acid nitrate of mercury, potassa fusa, and chloride of zinc, in stick, are doubtless good, but not so good as the galvano-caustic. The worst case of lupus of the nose I ever saw was the one illustrated in the previous drawing; it had existed for years, and was cured in a month after one free application of the galvanic cautery, every ulcerating tubercle of unhealthy tissue having been freely destroyed. Tonic treatment should, however, not be neglected; while as a palliative application, cod-liver oil is very good; arsenic also is highly commended by Messrs. Hunt and Milton. The second drawing illustrates the case after recovery, showing the outline of the flap for a new nose. In some cases excision may be employed.

The lupus non-exedens may be regarded as an early stage of the lupus exedens; both have a papular origin and become tubercular, the tubercles ulcerating at a later stage.

Epithelial Cancer and Rodent Cancer may attack the nose, the former appearing at first as a warty growth which subsequently ulcerates; the latter as an ulcer from the first. In the epithelial cancer the margin of the sore is more irregular and thicker than in the rodent ulcer, although in advanced cases it is somewhat difficult to distinguish between the two. The treatment of both, however, consists in the total destruction of the ulcerating surface, with its edges, by cautery, escharotics, or the knife. I have treated many of the epithelial forms by means of the galvanic cautery with gratifying success. The disease is liable to return like other cancers.

Rhinoscopy.—The examination of the nasal cavity, may be made through the nostrils by means of a speculum, the ordinary bivalve being as good as any, or through the posterior nares by means of a mirror introduced behind

the soft palate after the same fashion as in laryngoscopy, the parts being reflected in the mirror illuminated by sun or artificial light. Much aid may also be obtained by means of the finger. Czermach speaks highly of the value of a small mirror introduced through the nostril, which should be well illuminated. I have, however, found all the help I wanted in posterior rhinoscopy, taking care to draw forward with great gentleness the soft palate by means of short forceps, but this method of examination is always a difficult one.

FIG. 31.

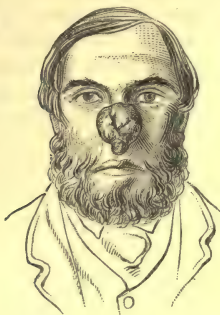
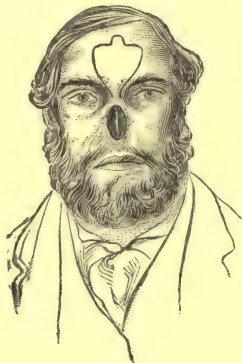


FIG. 32.



From life.

Diseases of the Nostril causing Obstruction.—These are very common, and for such the surgeon is often consulted. In the infant such a condition may be the result of congenital syphilis, which will be indicated by the history of the case and by the concomitant symptoms. The *snuffles* in infancy are very characteristic, and should always direct the practitioner to look out for some syphilitic affection; in isolated cases such a symptom may be the only one of hereditary syphilis, and by proper treatment it may be cured without any other complication making its appearance; although, as a rule, if looked for, some cutaneous affection will be observed. A grain of gray powder, and three or four grains of dried soda, twice a day, generally prove quite sufficient to cure the disease. When the mother is suckling, the child may be physicked through the mother, five or six grains of the iodide of potassium with quinine, given half an hour before suckling, three times a day, answering every purpose. Of late years I have followed no other practice.

Warty Growths are sometimes met with at the orifice of the nostril, causing obstruction. I have recorded such a case; they are cured by the removal of the growths.

Foreign Bodies in the Nasal Cavity.—In older children, suffering from any obstruction to the nasal cavity, the presence of a foreign body should always be suspected; the absence of a history in such instances should never be allowed to mislead the practitioner, as instances are not uncommon where some foreign body has been left in the nasal canal for many months. A child, four years of age, not long since came under my care, who had suffered from all the miseries of an obstructed nasal passage for eight months, from the presence of a plum-stone. Many remedies had been tried, but without effect, the foreign body being unsuspected; its removal was rapidly followed by convalescence. Ulcerations of the mucous membrane, from the inflammation excited by the foreign body, may tempt the surgeon to

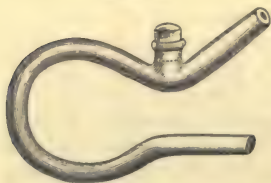
overlook the nature of the case; he must therefore remember that such a disease as ulceration of the nose in children, except at the immediate orifice, is by no means common, and that the probabilities of its being excited by a foreign body are very great. When only one nostril is affected, the diagnosis is more sure. The removal of these bodies, when firmly impacted, requires some care, and the administration of chloroform cannot be too highly recommended, particularly when the child is young. A firm, hook-bent probe, introduced down the floor of the nose, may be passed with facility behind the foreign body; or a noose of wire, twisted or not, inserted along the septum, and half turned, will generally, after one or two attempts, hook out the offending body; in some cases a pair of forceps will suffice. Gingerbread and other soft material should be scooped out, and the nose well syringed. I have never known any good result from syringing this cavity when any solid body has become impacted, except for cleanliness. Mechanical means always succeed, and are the simplest, particularly when the child is under the influence of chloroform. In older children and in adult life, obstruction to the nasal passage may be produced by many diseases. The presence of a foreign body may be the cause, in which case a true history will generally be given, and thus the surgeon is more likely to arrive at a just conclusion as to the character of the disease.

Polypus Nasi.—This is a common affection; it may be found in one or both nostrils, in the old or young; it may be of a simple gelatinous, fibro-cellular, or fibrous structure, or of a malignant nature. The gelatiniform and the fibro-cellular forms are by far the most common, and are not difficult to recognize; they, as a rule, spring from the middle turbinated bone and from its posterior portion; they may, however, grow from other parts. I have only removed one from the septum.

They are seldom recognized in an early condition, as they cause no pain and but little inconvenience; a slight excess of discharge is the earliest symptom, and this is generally regarded as being the result of "cold;" but when this secretion is examined, it will be observed to be more serous than is found to exist in an ordinary coryza. The discharge continuing, may at last cause some anxiety to the patient, and if the surgeon be consulted, a careful examination with a speculum should be instituted, when a polypus, or rather a fringe of polypi, will often be observed on the margin of the middle turbinated bone. When the disease has been made out, removal of the growth is the only effectual treatment. Tonics and local astringents may for a time retard their growth, but rarely effect a cure. The use of tannin as a snuff has been very successful in my hands in causing the sloughing off of even the largest polypi ("Lancet," Feb., 1867); it is an uncertain remedy in large polypi, but is always of great value in destroying the smaller ones, and thus in checking the progress of the disease.

I have had several instruments made to apply the tannin, but the bent glass tube, illustrated below, is as good as any; it is modified from one made by a patient for his own use, and answers well. The tannin is put into the small receptacle in the upper half, one end of the tube into the nostril, and the other into the mouth.

FIG. 33.



The removal of the softer kinds of polypi should always be by abruption. Some surgeons employ a long pair of narrow well-made forceps, which fix the pedicle, and then, by a slight twist and some force, the removal of the growth is effected. The best instrument known is the

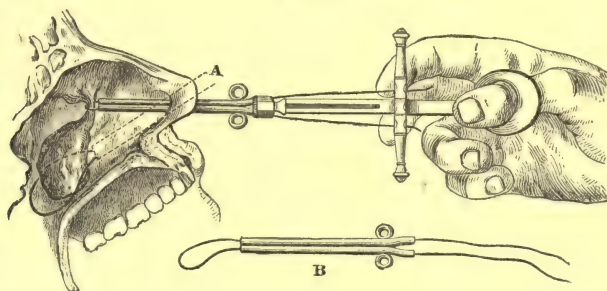
"noose," and the one illustrated on the next page is the form I prefer. It is so

constructed that a loop of wire introduced along the septum, and half turned, can be made to pass over the polypus and encircle its peduncle (Fig. 34 A). The loop is then drawn home, the growth strangled at its neck, and abruptly. By these means the polypus is removed as a whole and bleeding is prevented; consequently, by the use of this instrument, the nose can generally be cleared at one operation. In some half dozen cases I have cured the disease by cutting off the turbinated bone from which these polypi grow with a long pair of scissors. A few days after the removal of the polypi by the snare, tannin, as a snuff, may be employed.

This form of polypus seems to be more common in men than women, and is a disease of young adult life. I have, however, in one instance, known it to appear in a man aged seventy-five.

Dr. Thudichum successfully employs the wire snare; but instead of tearing away the growth, he cuts it off, heating the wire with the galvanic cautery.

FIG. 34.



The firmer and fibrous forms of Polypi seldom spring from the turbinated bones; they are by no means so common as the gelatinous; they grow more frequently from the upper and posterior portion of the nasal cavity, and have a periosteal origin. They do not make their appearance so early in life as the gelatinous, are far more serious in their nature, and more difficult, on account of their position, to treat; when removed, they rarely return. The best mode of treatment is to ligature them through the nose by means of a loop of whipcord or wire passed through the nostril into the pharynx and slipped over the growth; when this operation cannot be performed, the nostril may be laid open to give room for manipulation, or it may be necessary to remove part of the upper jaw to get at the tumor.

In 1865 I removed a large tumor of this kind which completely obstructed the posterior nares of a boy, *æt.* 14, by the ligature introduced through the nostril (*"Path. Trans."* vol. xviii). In 1868 I removed a second from a lad, *æt.* 18, in the same way; and recently I had to take away a portion of the upper jaw to make room to get at a like tumor filling up the nostril from behind.

Some of these polypi grow from the antrum, and press inwards. The surgeon should bear this fact in mind in examining a case, for it may materially affect his treatment.

Cancerous Tumors of the Nose are found in practice, although not frequently; they may press forwards or backwards, filling in the anterior or posterior nares, and they are difficult to diagnose. They are, perhaps, more common in the old than in the young, although two cases have passed

under my care in patients under thirty. They are generally associated with bleeding, either from the nose or pharynx.

Their removal, when it can be effected, is an expedient practice, if only to give relief, and this is to be done much in the same way as in the other varieties of polypi.

There are other conditions of the nasal cavity which are not infrequently mistaken for polypus; many such have passed under my notice, the patients applying for the removal of the growth when, in reality, no growth existed.

The first condition which I shall bring forward is a *malformation of the septum nasi*, the septum projecting either into the right or left nostril, and thus causing more or less obstruction to respiration, leading a superficial observer to believe in the presence of some new growth. This deformity may likewise be the result of an injury. The knowledge of the existence of such a condition is quite sufficient to prevent any careful surgeon falling into this error. I have removed from a boy a *cartilaginous outgrowth* from the septum which obstructed the nostril; it had a base the size of a sixpence.

Another condition of the nose which may be, and frequently is, mistaken for polypus, is a *chronic inflammation and consequent thickening of its mucous lining*. The patient complains of difficulty in respiration, and feels that there is something in the nose which mechanically impedes that function. On examining the cavity, a smooth, projecting, and firm outgrowth will be observed on its outer wall, which may be regarded as a polypus, but which is really only the lower turbinated bone covered by a thickened and inflamed mucous membrane.

If a little care be taken in the history of the case, an obstruction to the respiration will probably be the only symptom of importance; there will be no serous discharge, such as is found to be so copious in cases of polypi, although there may be a discharge of tenacious mucus; but this is not common. The secreting function of the mucous membrane in these cases will generally be found diminished, and a great dryness present, accompanied with a loss of the sense of smell.

The best treatment in such examples is the constitutional, in the form of tonics, using the one which appears to be most suited to the general wants of the patient's system. Some slight stimulating lotion, such as the sulphate or chloride of zinc, or nitrate of silver, of the strength of two grains to the ounce, may at times be required, but constitutional means alone are generally sufficient. Removal of the turbinated bone for this affection has been advocated and performed by some surgeons. I have adopted the practice in a few obstinate cases.

It is worthy of observation that this disease is at times confined to the mucous membrane over the lower turbinated bone; the reasons for which fact I am unable to explain. The septum may likewise be the subject of inflammation, either acute or chronic; and, as a result, great swelling of the soft parts covering it in will be present, giving rise to obstruction; when pus exists, an early opening is advantageous; in some cases a perforating ulcer may appear; in other, exfoliation of the cartilage.

Ozæna.—We will now proceed to the consideration of another large and important class of cases, which are too frequently treated of under the name of *ozæna*, but which essentially depend upon many different morbid conditions. In all an offensive discharge, or rather smell, is the common symptom, giving rise to the term designating the disease.

I am not aware that it has ever been satisfactorily proved that this offensive smell is the result of any morbid secretion of the part; my own expe-

rience has not furnished me with any information tending to confirm such an idea, and I believe that the fetor is generally, if not always, the result of the decomposition of the retained mucus; at times associated with an ulcer of the mucous membrane; and at other times with some diseased bone, the result of syphilis or otherwise. The disease generally progresses very insidiously, and many months have usually elapsed before the surgeon or medical adviser is consulted.

The patient at first believes the symptoms to depend upon an ordinary catarrh; the discharge from the nose is thick, but not offensive, and the sense of smell is more or less impaired. If these symptoms continue, the health of the sufferer generally declines, and being generally found in weakly and delicate people, the physician is consulted for the want of power, the local symptoms assuming a secondary importance.

If the nose be examined, as it should be, with a speculum, to obtain a good view of the whole, the only morbid condition which will be visible is intense congestion of the mucous membrane; it will not be much, if at all, thickened, but will be of a deep color, evidently the result of engorged vessels. This fact is of some value and interest, as this morbid condition is associated with excess of secretion, while in those cases of thickened mucous membrane which have been previously alluded to there is a marked deficiency.

The only correct and satisfactory treatment is the constitutional. Improve the general condition of the body, and the local disease will disappear. To this end consider well the hygienic agents with which the patient is surrounded; if any be deficient, let the deficiencies be supplied; if tonics, as quinine or iron, should be indicated, let them be administered. Attend to the secretions, and remove all external and internal causes which may prove detrimental to health. The local treatment consists in absolute cleanliness and the removal of all retained secretions, and for this purpose there is nothing equal to the use of the douche (Fig. 29), saline medicated lotions being employed. The inhalation of steam at times will assist the removal of the secretion and relieve the state of fulness of the part which some patients so much complain of. In other cases the injection of warm water affords relief, especially if the discharges have a tendency to desiccate, adhere to the mucous lining, and, as a consequence, to putrefy. It is this putrefaction of the retained muco-purulent secretion on which essentially depends the condition denominated *ozæna*. *Ozæna*, then, may be simply the result of a state like that which has been just described, allowed to progress too far without treatment; and if so, it must be treated on like principles, the offensive discharge must be constantly removed by means of a douche or syringe used freely, with a good and steady stream. If well done, no muco-purulent secretion will be allowed to remain to decompose, and, as a result, the one most troublesome symptom of fetor will be removed and in future be prevented. Medicated lotions in such examples are sometimes required, such as Condyl's fluid, carbolic acid, the sulphate or chloride of zinc, or nitrate of silver, in the strength of about one grain to the ounce of water.

But *ozæna* does not always depend upon such simple local conditions; in some instances ulceration of the passage in some part may be observed with the speculum, and an occasional escape of a blood-stained, muco-purulent secretion should lead the surgeon to suspect the existence of such a condition.

The principles of treatment, under these circumstances, are—tonics constitutionally, with cleanliness locally; topical stimulants may be employed

when simpler means have failed, or when great indolence of the part is present. But the retention and decomposition of the morbid secretions being the cause of the fetor, by proper treatment this ozena may be soon destroyed. By constitutional means, combined perhaps with local ones, the causes or rather pathological conditions upon which the disease depends may be removed, and a recovery ensue.

Much time, however, is frequently required to insure such a result, several months being often not long enough; but as the fetor is the chief symptom of annoyance to the sufferer, such may speedily be removed by the mechanical and local means already suggested, and thus the worst feature of the disease is destroyed, and the mental as well as the physical comfort of the patient secured.

Let, however, this inflammatory action and perhaps ulceration continue, and a different result will follow. As we see in other parts, so we find in the nose, the bone itself may become involved, inflammation take place, and as a result necrosis follow. In so-called strumous subjects this condition is not infrequent, although I have no evidence to give that such a necrosis is always the result of the extension of the inflammation from the soft parts around the bone to the bone itself. In many cases, however, if not in the majority, I believe the disease originates in the bones, for we well know that strumous subjects are very liable to an otitis and perioritis of a low form, followed by necrosis, whether the result of an injury or otherwise.

In the nose such a necrosis is not an infrequent condition, and this is, as a consequence, another cause of the disease described as *ozena*. It is found in children, as well as in adult life, and may be the result of injury, extension of disease from the soft parts covering the bones, or associated with the so-called strumous diathesis, or with the syphilitic poison. At times it may take place without any such distinct cause, it being well known that inflammation of the bone in other parts may also arise *per se*, and no visible or positive cause being made out, it is then described as idiopathic.

When *ozena* is the result of necrosed bone, the fetor is generally of a peculiar character, being such as is well known to accompany diseased bone. By careful examination with the speculum or probe, bone will often be detected, whereby the nature of the disease becomes tolerably evident. In early life, I believe that inherited syphilis is a more frequent cause than is generally suspected, and this opinion has been made clear by the presence of other marked symptoms in some cases, such as old skin diseases, syphilitic teeth, or keratitis.

To form a correct opinion, a careful history of the case must be obtained, and well-known symptoms not overlooked, for unless an accurate knowledge of the cause can be acquired, the treatment to be adopted must be doubtful, and consequently so far unsuccessful.

TREATMENT.—When the presence of necrosed bone has been made out as a cause of the disease called *ozena*, it is tolerably evident that the patient will not recover until the fetid bone has been removed, or rather has exfoliated. To this end the preservation of perfect cleanliness by means of the douche or syringe, with or without stimulating or antiseptic lotions, may be employed, and tonics administered. If syphilis, either hereditary or acquired, is the apparent cause, our remedies must be modified to the general requirements of the patient. Mercurials are seldom necessary, although in children suffering from this disease, where the history and other symptoms of congenital syphilis are present, I have given them, asso-

ciated with tonics, with marked benefit, and in obstinate cases in adult life such a combination may also be employed. The perchloride and green iodide have proved themselves the best forms in my hands, and when combined with tonics, such as quinine, bark, or iron, they are most valuable. The perchloride I generally give with bark, and the iodide in pills at bedtime, the patient taking at the same time the syrup of the iodide of iron and the iodide of potassium in some bitter infusion, such as quassia. If mercurials are not indicated or required, the combination of the iodides of iron and potassium cannot be too highly praised.

In strumous subjects, perfect local cleanliness, and perhaps stimulants, accompanied with tonics, as cod-liver oil, quinine, or iron, alone or in combination, generally suffice, and by such means a cure may confidently be promised.

Nasal Calculi or Rhinolithes.—Such cases have been recorded; I have, however, never seen an instance. They may be small or so large as to obstruct the nostril. They may be formed round foreign bodies introduced from without. Obstruction and more or less pain are said to be the chief symptoms, and occasionally a copious discharge of mucus or pus. The calculus will be detected on an examination, and, when found, it should be removed by douche, snare, or forceps. Cases are on record in which the concretion was crushed before removal.

Disease of the Frontal Sinus.—The frontal sinuses, as part of the nose, are liable to many of its diseases. Acute or chronic catarrhal inflammation, giving rise to a dull heavy pain over the forehead, is by no means uncommon. The inhalation of the fumes of half a grain, or more, of opium thrown on a hot piece of metal, often gives speedy relief.

Acute suppuration of these sinuses is occasionally met with, and is attended with severe local and general symptoms. The application of the trephine to the outer shell of bone, may, under these circumstances, be required. Necrosis of the bones covering in the sinuses may exist, as also fracture. New growths may likewise be found in this locality—cancerous, myeloid, or bony; the *ivory osseous growths* are more frequently found in the air-cells of the frontal bone and nasal fossæ than in any other locality, and from modern investigations they appear to have a periosteal origin, and soon become loose. In Hilton's well-known case it sloughed away. M. Oliver's treatise upon the subject published in Paris in 1869, gives all the facts known about them. In all tumors occupying the centre of the frontal region, the possibility that any one may be a hernia of the brain or its membranes should be borne in mind.

Rhinoplastic or Taliacotian Operations.—Since Tagliacozzi in 1597 made a nose by taking a flap of skin from the arm, all operations undertaken for the same purpose have acquired a peculiar interest, although modern surgeons, instead of following the great Italian surgeon's example, generally prefer to adopt the Indian method, and take the integument from the forehead. The operation is by no means a common one. It may be undertaken to restore a nose wholly, or in part, and the amount of healthy integument required for this purpose will be regulated by the want. The ingenuity of the surgeon will be taxed in every case to adapt his operation to its special requirements. He must, however, always be careful to give himself abundance of new material; and having satisfied himself of the wants of the individual case, and that the parts upon which he is about to operate have long lost all traces of disease, he will map out upon the forehead of the patient that portion of integument he proposes to transplant, having planned it beforehand on a piece of paper, plaster or wash-

leather. The shape required for a whole nose will be such as is indicated in Figs. 32 and 35. The surgeon must

FIG. 35.



then make raw the whole surface of the old nose, to which the flap is to be united, cutting a deep groove close down to the bones bounding the nasal cavity for the reception of the new flap. A sponge may then be firmly pressed upon this raw surface to arrest the bleeding, whilst the surgeon proceeds to dissect up the integument he had previously marked out upon the forehead. In doing this, care should be observed not to bruise or otherwise injure this borrowed skin. The incision should be clean and extended down to the bone. The flap should be dissected up boldly and freely, care being observed to leave a good neck through which the circulation is to be maintained, and to make

it long enough to allow of its being turned round; for this purpose it is a good practice to make the incision on the side to which the twist is to be made a little longer than on the other.

When all bleeding has ceased, the frontal flap with the external surface still uppermost, is to be turned half round, and applied to the nasal raw surface, to which it is to be carefully stitched. The new nostrils are to be supported by oiled cotton-wool, or lint, and the surface covered with the same material to maintain its warmth. The gaping wound on the forehead is then to be brought together as far as possible by means of strapping, and left to heal by granulation. The sutures may be removed on the second or third day. For the next month the greatest care is called for in the dressing of the wound, and in keeping the nostrils up with a plug; and as soon as the new flap has consolidated, the neck of integument at the root of the nose may be divided. When the wound has healed, and the new organ has acquired an independent vitality, the formation of the columna may be proceeded with, and Liston's plan is the one generally employed. I will give it in his own words:

"Restoration of the columna is an operation which, in this and other civilized countries, must be more frequently required than the restoration of the whole nose. This latter operation came to be practiced in consequence of the frequency of mutilations as a punishment; but the punishment for some of our sins is left to Nature, and she generally relents before the whole of the organ disappears. The columna is very frequently destroyed by ulceration. The deformity produced by its loss, is not far short of that caused by destruction of the whole nose. Happily, after the ulceration has been checked, the part can be renewed neatly, safely, and without much suffering to the patient. The operation which I have practiced successfully for some years, and in many instances, is thus performed: The inner surface of the apex is first pared. A sharp-pointed bistoury is then passed through the upper lip—previously stretched and raised by an assistant—close to the ruins of the former columna, and about an eighth of an inch on one side of the mesial line. The incision is continued down, in a straight direction, to the free margin of the lip; and a similar one, parallel to the former, is made on the opposite side of the mesial line, so as to insulate a flap about a quarter of an inch in breadth, and composed of skin, mucous membrane, and interposed substance. The frænulum is then

divided, and the prolabium of the flap removed. In order to fix the new columna firmly and with accuracy in its proper place, a sewing needle is passed from without through the apex of the nose, and obliquely through the extremity of the elevated flap; a few turns of thread over this suffice to approximate and retain the surfaces. It is to be observed that the flap is not twisted round, as in the operation already detailed, but simply elevated, so as to do away with the risk of failure. Twisting is here unnecessary, for the mucous lining of the lip, forming the outer surface of the columna, readily assumes the color and appearance of integument, after exposure for some time. The fixing of the columna having been accomplished, the edges of the lip must be neatly brought together."

The sutures may be removed on the third or fourth day, when the parts have as a rule cicatrized. The ultimate result of the case materially rests upon the care the surgeon bestows upon its after-treatment. Mr. Skey has had some excellent results in his practice. I lately saw ~~one~~ at Guy's that he had operated upon years ago; it was very good. It is well also to remember Mr. Skey's advice when he says, "Let it be the patient who urges the operation."

Of late years Langenbeck has suggested the propriety of dissecting up the periosteum from the frontal bone with the skin flap, so as to give a bony nose, but it is a question how far this osteo-rhinoplasty is an advantage. The operation has not found much favor.

When only one ala has to be restored, the flap may either be taken from the nose itself, or from the cheek, the ingenuity of the surgeon suggesting the special plan.

CHAPTER XXI.

SURGICAL AFFECTIONS OF THE LARYNX AND TRACHEA.

WOUNDS of the throat are generally made by the hands of the suicide; they have consequently a double interest; the dangers of the local injury being complicated with the peculiar mental condition of the sufferer. It is essential, therefore, for the surgeon to dwell seriously beforehand upon the necessities of these cases, in order that in the hour of danger he may be prepared to act with energy and decision.

In the majority of cases of "cut throat" the wound is only of a superficial nature, it is simply a wound involving skin or skin and muscle, and does not implicate either the pharynx or the respiratory tract. These cases require no other local treatment than that usually employed for skin wounds, such as sutures and warm water-dressing.

When the wound is of a deeper character it may penetrate into the pharynx and air-passages, or involve the deep vessels. The dangers of the case are much determined by the position of the wound.

My colleague Mr. Durham in an able article in *Holmes's Surgery* (2d ed.) assigns that of 158 unselected cases the wound was situated

Above the hyoid bone in	11 cases.
Through the thyro-hyoid membrane in	45 "
Through the thyroid cartilage in	35 "
Through the crico-thyroid membrane in	26 "
Into the trachea in	41 "

The respiratory tract was opened in about two-thirds of the cases.

Under all circumstances *hemorrhage* as the direct result of a divided or

wounded artery or vein is to be apprehended. The deep position of the carotid artery and jugular vein in the majority of cases protects them from injury; when they are divided death is usually rapid. Partial or complete division of some of the branches of these vessels is however not infrequent.

Blood may flow into the trachea and cause asphyxia suddenly or slowly. It may coagulate over the orifice of the larynx with the same result. Le Gros Clark has shown ("Surg. Diag.," 1870) how air may enter the circulation through a partially divided vein and destroy life in twenty-four hours. It is, therefore, the first duty of the surgeon to arrest hemorrhage either by the application of a ligature or by torsion; the latter mode is to be preferred. Venous hemorrhage may generally be controlled by pressure, but large veins may be tied or twisted.

When the incision is *above the hyoid bone* and deep, the tongue may be divided, and the loosened portion falling over the orifice of the larynx may cause sudden suffocation. The surgeon recognizing the nature of the accident should prevent the possibility of this contingency by passing a thread through the tongue and drawing it forward.

Again, when the cut is *just above the thyroid cartilage* the epiglottis may be divided, and this falling into the larynx may cause a fatal dyspnoea. To prevent this a stitch should be inserted into the divided portion and the parts adjusted. The same result may take place when any part of the orifice of the larynx has been detached. Indeed all loose bodies likely to obstruct respiration are to be fixed. Emphysema is by no means an uncommon complication of cut throat when the respiratory tract has been opened. It is more common when the external wound is small. It is not as a rule a dangerous occurrence.

The secondary dangers of wounds of the throat involving the air-passages are inflammation of the air-tubes and lungs. When the pharynx or œsophagus has been opened this risk is aggravated by the possible introduction of food into the trachea. Purulent infiltration of the cellular tissue of the neck may ensue—or œdema of the glottis—and at a later date the air-passages may be obstructed by the cicatrization of the wound; or a permanent fistulous opening may be left.

By way of summary:

The immediate danger of a wound in the throat depends (1) on the quantity of blood lost; (2) on the risk of suffocation from that blood getting into the air-tube; (3) the danger of suffocation by tissues divided and partially separated from their connections.

The secondary dangers are those of œdema of the larynx and inflammation of the air-passages, and later on from subsequent narrowing of the divided tube by the contraction of new tissue around it.

TREATMENT.—The first duty of the surgeon under all circumstances is to *arrest hemorrhage*. Arteries are to be ligatured or twisted, with all deep veins, when moderate pressure fails to check the flow of blood. A wounded artery or vein must be ligatured above and below the wound. A small wound in the internal jugular vein should be tied with a fine thread. Wounds of large veins are always of grave importance.

Wounds of large vessels almost always prove speedily fatal. A man in Guy's, æt. 21, in a fit of despondency cut his throat, and died from profuse hemorrhage into the lung before help could be obtained. The blood was found after death to have come from a divided superior thyroid artery. An inmate of St. George's divided the left common carotid artery, and wounded the internal jugular vein with a penknife, and died before the house surgeon could arrive. "A gentleman, who committed suicide by

cutting deeply between the os hyoides and thyroid cartilage, partially divided the external carotid artery on the right side, just as it was given off; the flow of blood was immense, and he was found dead within ten minutes of the infliction of the wound." (Fothergillian Prize Essay for 1836, by my father, the late Mr. T. E. Bryant.) In Guy's Museum, prep. 1711⁷⁰, the left internal jugular vein may be seen divided, the cut was between the thyroid and cricoid cartilages, and proved speedily fatal. Prep. 1711⁹, shows division of the inferior thyroid artery.

The second duty of the surgeon is to *prevent suffocation*. He is to see that the respiratory orifice is kept clear of blood, or any divided structure, such as the tongue or epiglottis. Coagula are to be speedily removed, and respiration encouraged by artificial means when natural processes have failed.

When the larynx or trachea has been wounded, the aim of the surgeon must be directed to keep the divided tube in continuity, and not to allow the upper portion to overlap the lower, and thus obstruct the respiration; at the same time care must be taken to keep the wounded parts sufficiently open to allow of the escape of the mucus, which is sure to be profuse, and to permit the free ingress of air.

Should the wound be very extensive, and difficulties arise in carrying out the above indications, sutures may be introduced; but the judgment of the surgeon and the exigencies of the individual case will sufficiently point out to the thoughtful practitioner when they may be necessary. In large wounds, where the parts cannot be kept together, a suture is often of immense benefit, and when applied sutures should be firmly so, including often the whole thickness of the tissues. Their objects can only be to fix the divided parts in position, and to prevent by their sudden movement any mechanical obstruction to the respiratory act; to do this effectually, the measures to be employed should be boldly executed. The head should be kept forwards by the application of bandages, and water-dressing applied to the wound itself; constant attention is demanded of the nurse to keep the wound clear of discharge, and to see that no obstruction to the breathing take place. The atmosphere the patient breathes should be kept warm and made moist by the introduction of steam, and the wound covered with muslin; the closest attention should be paid to the patient by a skilful nurse; and every mental and bodily want or weakness cared for.

As regards nourishment, abundance should always be provided, although it is not such an easy task to get the patient to take it.

When the pharynx or œsophagus is extensively opened, the patient should never be allowed to swallow, but he must be fed by means of a tube passed either through the nose or mouth, not through the wound, and directed with the finger carefully down the throat into the lower portion of the œsophagus. Through this, beef tea, eggs, brandy, and other liquid nourishment, such as the symptoms indicate, must be periodically administered. I have an instance before me where the pharynx was extensively opened above the os hyoides, and where the patient was kept alive by such means for nearly six weeks, the tube having been passed through the nose; at the end of this time he was able to swallow, and recovery ensued. When acting as dresser to the late Mr. Ashton Key I had a case where the wound was inflicted through the trachea, dividing the œsophagus; in this instance the man was fed twice daily through a tube passed through the mouth and directed with care into the lower œsophageal opening; this practice was carried on for many weeks, and was rewarded by recovery. The plan of treatment as just indicated, however, is only rational, and is such as any surgeon would naturally suggest. All complications, such as suppuration

in the cellular tissues around the wound, bronchitis, or broncho-pneumonia, are to be dealt with as they arise. Some surgeons have suggested the propriety of tracheotomy in severe cases of cut throat, so as to allow the wound to be closed. I am unable, however, to see the advantages offered by this practice in ordinary cases; although in wounds involving the epiglottis or upper part of the larynx, in which inflammatory œdema appears as a secondary result, and by causing obstruction to respiration threatens life, there is no doubt as to the wisdom of the practice. These cases are, however, not common.

Amongst the more remote dangers of such wounds the mechanical obstruction of exuberant granulations ought to be mentioned; likewise, some narrowing of the air-passage, as a consequence of contraction of the cicatrix, or tracheal fistulæ. These results are common to traumatic and surgical wounds of the part. In prep. 1711¹¹ Guy's Hosp. Mus., both the trachea and œsophagus are much contracted above the opening, and in a less degree below. It was taken from a patient who had lived many years after a wound which had involved both the trachea and œsophagus.

Foreign Bodies in the Windpipe.—There are few accidents which excite more anxiety and alarm to a looker-on than the passage of a foreign body into the larynx or trachea. The unfortunate subject, from apparent health or happiness is suddenly seized with violent struggles for life, and to all appearances that life is to be curtailed, and its value exchanged for a sudden and painful death. In the surgeon's mind not less painful feelings are excited, for unless by his art timely relief can be afforded, the danger which is apparent becomes real, and death is almost a certainty.

The majority of the victims of such an accident are children, although adults are not exempt from such a contingency.

The foreign body may be inhaled at any moment, a sudden inspiration being sufficient when the mouth is full, especially when that foreign body is smooth, light, or small, such as a fruit stone, bead, bean, nut, or coin. Vomited matter may likewise be drawn by inspiration into the air-tubes by patients in a state of unconsciousness, as when under chloroform, and produce death, or through fistulous openings between the œsophagus and trachea, the result of simple or cancerous ulceration. The body may be lodged at the orifice of the larynx (Fig. 36), and thus cause sudden asphyxia; or pass into the rima, where it may be arrested, or into the trachea or bronchi, the right bronchus being its most common seat (Fig. 37).

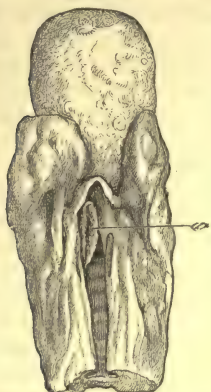
The size and shape of the foreign body will determine many of these points. A large one will naturally be arrested at the orifice of the larynx, when a small one will probably pass through. A jagged and light body, such as a piece of nutshell, would be more likely to be caught in the rima than a small round body, as a bean.

The foreign body may be caught in the larynx or lodged in the trachea; in some instances it may be impacted in one or other bronchus, in the right, as a rule. In the case of a child, æt. 2½, upon whom I unsuccessfully operated in 1864, a date stone was found impacted in the right bronchus, and its upper end was pressing against the left side of the trachea, and exciting ulceration (Fig. 37). The child lived four days. In another case recorded in my "Clinical Surgery," Part II, a bean was firmly impacted in the right bronchus, causing complete obstruction to the right lung.

The fact that the septum at the subdivision of the trachea is somewhat to the left of the median line, is probably the explanation of the fact that the right bronchus is more frequently the seat of the foreign body than the left. This was pointed out by Goodall of Dublin. The larger size of the right bronchus doubtless favors this tendency.

The symptoms which attend the entrance of a foreign body into the air-passage are somewhat characteristic, those that follow are often obscure. The most typical is a violent convulsive cough *coming on abruptly*, followed by difficult respiration, and a feeling of suffocation. This spasmodic cough may also recur at intervals on any movement.

FIG. 36.



Bone in larynx causing death, taken from a child 11 months old. Prep. 1710^a.

FIG. 37.



Date stone impacted in right bronchus. Prep. 1717^b.

When the voice is altered in character, *whistling* or *stridulous*, it is suggestive of the foreign body being near the rima, and impacted; and when there is tenderness of the larynx on manipulation or pain, this suspicion is strengthened.

When the breathing of the patient is at times natural, and at others disturbed by a paroxysm of cough or dyspnoea, and when these symptoms are brought on by any movement or violent respiratory effort, it is probable that the foreign body is loose in the trachea or one of its divisions; indeed, patients are at times conscious of the movement of the body. When by auscultation it can be made out that air enters one lung freely and the other feebly, the exact seat of the impaction of the foreign body is indicated, and the amount of dyspnoea present will depend upon the closeness of the impaction.

A piece of meat may become impacted in the rima glottidis and cause instantaneous death (Prep. Guy's Hosp. Mus. 1710). When an extraneous body gets into any part of the larynx, but more particularly into the ventricles, the spasmodic derangement to which it gives rise too often proves speedily fatal. In children rapid suffocation is a common result of such a cause, death being more from spasm of the glottis than from mechanical obstruction by the foreign body.

When the extraneous body has passed through the larynx into the trachea the symptoms are not so distressing. There may be long intervals of repose between the attacks of laryngeal spasm; but any spasm may prove fatal.

Many cases are now on record in which foreign bodies, particularly coins, have been impacted in a bronchus, and have given rise to no urgent symptoms for years. Dupuytren in one of his lectures given in 1833, relates a case where a coin was known to have been in the air-passage for ten years without producing any very distressing effects, and was found after death

to occupy a tubercular excavation. Professor Gross gives a case in which a portion of bone is said to have been coughed up, after having been retained for sixty years. Cases such as these, however, should never allow the surgeon to rest satisfied, or permit a foreign body to remain in the air-passages; for so long as it does, death may at any moment be produced by sudden convulsive laryngeal spasm.

Difficulty of breathing is not uncommon as a consequence of the arrest of food in the œsophagus or lower part of the pharynx, and at first sight the surgeon might think that the symptoms were due to the presence of some foreign body in the air-passage. When doubt exists the patient should be made to swallow; in laryngeal obstruction no difficulty will be experienced by this act, in pharyngeal it will be impossible. Under other circumstances the careful introduction of a probang into the œsophagus may be made, and under all a careful exploration of the throat and pharynx with the finger. When the foreign body is impacted in the pharynx, and cannot be removed, and laryngeal spasm threatens life, the windpipe may require to be opened. One should always hesitate to employ force in pressing the foreign body downwards.

TREATMENT.—Given the diagnosis of a foreign body in the windpipe, our duty lies in the endeavor to remove it. There should be no deviation from this principle of practice; it is a truth that so long as a foreign body remains in the air-passage sudden death is imminent, for by its movement a spasm of the larynx may be produced, and any spasm may prove fatal. The surgeon should not allow himself to be misled by the mildness of the symptoms, nor by the knowledge that in rare instances foreign bodies have remained in the passage for years, and have after years been expelled, for such cases are exceptional. The accident is one that will inevitably destroy life, although at what time danger may appear, or in what form, may be wrapped in doubt.

In all urgent cases in which spasm of the larynx threatens life *Tracheotomy* should be performed; with an opening in the trachea, a fatal spasm is prevented, and the surgeon may then proceed to investigate the case. In cases in which life appears to be extinguished the same practice should be adopted, artificial respiration being subsequently maintained. Should the symptoms point to the larynx as the seat of the impaction, the upper orifice should be closely examined by the finger introduced through the mouth, and a full-sized bougie or catheter introduced from below through the wound into the larynx; by these measures any foreign body caught and impacted in the larynx itself may be removed. The laryngoscope at times will be an invaluable aid in guiding to the position of the foreign body and in effecting its extraction. It is only applicable, however, in adults. When the position of the foreign body is known its removal may be facilitated by curved forceps.

In children the opening in the trachea should always be as high as possible, and there is no objection to dividing the cricoid cartilage (*laryngo-tracheotomy*) to get at the larynx. Laryngotomy is scarcely applicable to these cases, the majority being found in children. Should the foreign body be so fixed in the larynx as to be immovable by the means suggested the thyroid cartilage must be laid open by increasing the incision upwards; by doing this the larynx will be fully exposed, and its removal facilitated. When the foreign body has passed the larynx and is in the trachea, a free opening should be made low down in the passage; when this is done it not unfrequently happens that the foreign body is expelled, should it not be, the patient may be inverted, and succussion employed, that is, the patient

should be patted sharply on the back or shaken with the view of dislodging it.

Some surgeons advise the introduction of forceps through the wound into the trachea, for the removal of the foreign body. The practice, however, is not a very successful one. Rare cases are on record, in which success followed the attempt, but many more are to be found in which failure ensued. Should it be adopted, care must be observed not to use force.

Should these means fail to remove the foreign body, the patient must be left; the wound in the air-tube being kept open.

When the foreign body is in the larynx, the canula may be introduced, but when in the trachea or bronchus, such a practice is injurious, as it prevents its escape. Under these circumstances Hilton's suggestion is undoubtedly the best—the formation of a transverse valvular opening in the trachea. The cutting out of a portion of the trachea seems quite unnecessary. This valvular opening will readily allow of the escape of the foreign body when impelled against its inner surface. The tracheal opening may also be held open by hooks, or fastened by ligatures. In one case in which the trachea was deep I managed to keep the tracheal wound open by means of a divided ring of strong wire, embracing the neck, its two ends being made to hook into the opening into the air-passage, and act as retractors. In another, I held the wound apart by means of a wire instrument made on the principle of the eye speculum. Should our efforts at the removal of the body fail at one time, they may be successful at another. Mr. Brunel's well-known case is one in point. Mr. Durham tells us, from an analysis of 554 cases of foreign bodies in the air-passages, that death resulted in 42 per cent. when no operation was performed, and in 24 per cent. when operative measures were resorted to, this result being greatly in favor of the latter practice. The foreign body having been removed, the chief danger has passed. There may be some inflammation of the air-passages, as a result of the irritation of the foreign body, but this usually subsides on the removal of its cause. In exceptional instances it may prove troublesome, if not fatal. The nature of the substance has also much influence in determining this result, smooth bodies being slightly irritating, jagged bodies more so. The operation of tracheotomy doubtless does something towards aggravating this condition. Such a complication is to be treated on rational principles, but in the majority of instances it will naturally subside on the removal of the offending body. Water-dressing to the wound, and a warm, moist atmosphere, are the two essential points of practice to be followed, after the removal of the cause, and, as a rule, convalescence speedily follows. Chloroform should always be administered in these cases when operative interference is called for.

Scald of the Larynx.—This somewhat common accident is doubtless engendered amongst the poor by the habit of feeding their children out of a teapot. The child, when thirsty and alone, being accustomed to drink from the "spout," seeks it from the kettle, and so scalds the pharynx and orifice of the larynx that œdematous inflammation of the part follows, in the same way as a blister arises by the application of boiling water or steam to any other tissue.

The symptoms caused by such an accident appear, as a rule, very speedily, the small chink of the glottis soon closes, and, as a consequence, a fatal result ensues, unless early relief can be obtained.

In some cases the mouth, with the soft palate, tongue, and fauces, will be found swollen and vesicated. There will be difficulty in swallowing, and some alteration in the character of the voice. The respiration rapidly becomes affected, and a spasmodic croupy cough appears, with stridulous

breathing. These symptoms may become gradually or rapidly worse. They may be complicated with attacks of spasmodic dyspnoea, at long or short intervals; but when these attacks appear, extreme danger is indicated, any spasm possibly proving fatal. A somewhat similar result may take place from the intentional or accidental swallowing of any corrosive poison or acid, or the inhalation of a flame.

TREATMENT.—In a fair proportion of these cases little other treatment than a warm bed, the application of a hot sponge to the larynx, and the inhalation of warm moist air, is ever needed; the symptoms subside as rapidly as they appear, three or four days seeing the worst of the case through; in these mild cases the laryngeal symptoms are probably never severe. When laryngeal symptoms exist, accompanied by spasm, the case assumes a threatening aspect; indeed, the first spasm may be the last. I have the notes of the case of a child, in whom the symptoms were so slight that no anxiety was felt, but one spasm took place two hours and a half after the accident, which put an end to life.

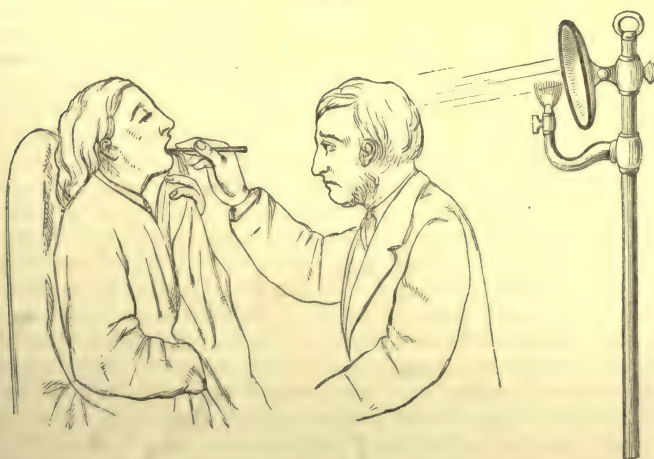
When symptoms are severe the operation of tracheotomy should be performed; indeed, I am disposed to recommend this operation in every case in which the symptoms are rapidly progressing, and laryngeal spasms co-exist. To postpone it too long, till the lungs become gorged with blood, and, consequently, disposed to inflammatory action, and the powers of the patient have become depressed, is a timid practice, and is certainly unsuccessful. In the opinion of many good surgeons, I know it is thought desirable to postpone operative interference as long as possible, to watch and wait. In this I do not agree. When laryngeal spasms exist with mechanical obstruction, nothing but opening the windpipe places the patient in safety. Out of nine cases consecutively treated by tracheotomy, five recovered. The statistics, however, of my colleague, Mr. Durham, are less favorable, twenty-three out of twenty-eight cases terminating fatally. In some instances the scarification or puncturing of the œdematous opening of the larynx and epiglottis gives great relief. I have been accustomed to do this by means of an ordinary tenaculum or mounted needle. Mr. Tudor, of the Dreadnought, has invented a useful instrument for the purpose called an epiglottome. The punctures into the œdematous tissue may be free; they never seem to do harm. Drs. Wallace and Bevan, of Dublin, have spoken very strongly in favor of the calomel treatment, two or three grains being given every hour until the symptoms are relieved; and Dr. Croly uses inunction at the same time. Other surgeons speak well of antimony, and it is, doubtless, a drug that should always be given; one, two, or three minims of the antimonial wine every quarter of an hour, till some effect has been made upon the disease, and then at longer intervals. The best local application to the larynx is the hot sponge. A blister over the upper part of the sternum sometimes does good, and in exceptional cases leeches to the larynx may be used. The time all these remedies, however, require to produce their effects is too long, and their action too uncertain, to allow the surgeon to depend upon them in acute cases; as accessories in the treatment they are of use, but as means of preventing death when obstruction exists and spasms are frequent they are not to be recommended. When an operation is performed it should be tracheotomy. Laryngotomy is inapplicable; it is too near to the disease. Chloroform may be given without fear.

Diseases of the Larynx requiring Tracheotomy.—Since the introduction of the laryngoscope our knowledge of the diseases of the larynx has so much increased, and the treatment of its different affections so much improved, that the subject has become somewhat a large one; so large,

indeed, that enterprising members of our profession have contrived to turn it into a specialty. This is a subject of regret, in a certain sense, for it tends to make the bulk of the profession, and with it the student, look upon laryngeal affections as difficult subjects of investigation, and beyond the reach of average skill. This is not, however, in any sense correct, for the use of the laryngoscope or throat speculum is no more difficult than that of any other instrument. To use it neatly and efficiently requires skill and some practice, but the same wants are also essential to every other surgical investigation. The first laryngoscope was introduced to the profession in 1829 by the late Dr. B. G. Babington, who, under the term "glottiscope" invented an instrument composed of a mirror fixed to a wire handle, which, being placed against the palate whilst the tongue was depressed, enabled him to view the upper part of the larynx. Garcia, the singer, in 1855 gave an impulse to the idea by throwing the sun's rays into the back of his mouth by means of a mirror held in his left hand; thus from a dentist's reflector introduced into his mouth, he could witness the movements of his larynx in the looking-glass. But to Drs. Czermak and Turck are unquestionably due the credit of having applied this mode of investigation in a scientific way to the diagnosis of laryngeal disease. They employed artificial illumination, however, instead of solar, adopting the practice of Helmholtz in ophthalmoscopic operations.

The ordinary mode of application of the instrument is very simple. The patient sits with his back to a good light, that of the sun is the best, or moderator, or gas-lamp. The lamp should be in a line with the patient's face, and on his right side; the surgeon faces the light and with the mirror fastened round his head reflects it on the patient. The patient is then directed to open his mouth, protrude his tongue and hold it with a handkerchief: a warmed mirror is introduced to the back of the fauces, the tongue at this time being depressed. The rays of light from the frontal mirror are then made to fall upon the pharyngeal one, and with a little arrangement the glottis and all the parts around—above or below—may be carefully examined.

FIG. 38.



The pharyngeal mirror may also be well illuminated by simply projecting the rays of light from a large reflector fastened behind a gas or moderator lamp, as seen in Fig. 38.

I have employed this method for several years and have found it more effectual than the use of the double mirror.

It will be impossible in the following chapter to give a full description of all the different affections to which the larynx is liable, nor would it be consistent with the object I have in view, for laryngeal affections come as much under the notice of the physician as the surgeon, and the latter is only consulted when medicine has failed to relieve symptoms, and evidence exists of some progressive affection which by causing obstruction to the respiratory act threatens life. In the following chapter I propose, therefore, to consider the diseases of the larynx in their surgical aspect only, and to view them simply in their relation to tracheotomy or other operative interference.

In a general way it may be asserted that tracheotomy may be called for under any circumstances in which obstruction exists to the respiratory act, mechanical or otherwise. In pharyngeal affections mechanically affecting the larynx; in laryngeal disease acute or chronic, inflammatory or otherwise. In tumors pressing from without upon the windpipe in some part of its course, or for some temporary purpose connected with operative surgery to insure the maintenance of the respiratory act during the removal of a large pharyngeal or maxillary tumor.

Pharyngeal Affections obstructing the Respiration.—**Abscesses** about the pharynx or tonsils at times cause laryngeal obstruction, and such an effect is to be met by puncturing the abscess with a guarded bistoury. Inflammatory and ulcerating affections of the throat, more particularly what is called diphtheritic, are apt to spread to the larynx and set up a laryngitis. Indeed Trousseau asserts that in most cases croup begins in the pharynx.

Tumors of the pharynx or tonsils are occasionally met with pressing upon the larynx, and interfering with its functions, a cyst may develop at the back of the tongue behind the epiglottis, and by its size almost close the laryngeal orifice; or a naso-pharyngeal tumor may so press downwards as not only to threaten life by suffocation, but to cause death. In one large naso-pharyngeal tumor I had to treat, the former effect was met with, but relief was given by the removal of the growth. In another of cancerous tumor of the pharynx above the soft palate which occurred in a boy *et. 18*, and which rapidly recurred after its removal, death ensued from suffocation, tracheotomy being rejected. Suffocation from simple enlargement of the tonsils I believe to be unknown, although, not from cancerous disease.

Affections of the Larynx requiring Tracheotomy.—*Inflammatory affections* can never exist long without causing some closure of the glottis, and thus endangering life. In acute laryngitis of catarrhal origin, in membranous croup, and in diphtheritic croup, a few hours may be sufficient to produce this effect, either from œdema of the larynx, suppuration of the larynx, or the effusion of a false membrane. In all the result is the same, mechanical closure of the glottis complicated with spasm; and in all, the important question presents itself to the practitioner, whether medical treatment can be sufficient to check the disease, or surgical aid in the way of operative interference is required. Trousseau, our great authority in this matter of tracheotomy in croup, maintained strongly, that the earlier the operation is performed the greater are the chances of success; that it ought to be performed before death is imminent; but to whatever degree asphyxia may have proceeded, tracheotomy ought to be tried, for there is a chance of success, provided the local lesion, the croup, constitutes the chief danger of the disease. In these views I entirely concur; they are physiologically sound and clinically correct. When the lungs have become

gorged with blood unfit for circulation by too protracted delay in operating, a successful issue can hardly be looked for: performed when the disease is steadily progressing, when it is unaffected by medical treatment, and before asphyxia, carbonæmia, or severe blood-poisoning has taken place, the chances of success are good; for it seems to be a clinical fact that in a large number of cases the extension of disease is arrested by the operation; "that by the time the disease has reached the air-passages it has exhausted itself, and that, if by admitting air to the lungs, by tracheotomy, the patient be prevented from dying, recovery will take place" (TROUSSEAU).

In Chronic Laryngitis, whether tubercular, syphilitic, or otherwise, tracheotomy may be required to prevent impending death or as a means of cure. For the first indication it should not be postponed too long, for too long often means too late, some spasmodic attack carrying off the patient. When these attacks consequently appear, and recur, tracheotomy should be performed. Tracheotomy as a means of cure is not sufficiently practiced. "It has been hitherto generally performed in the class of cases to which I have just alluded—to rescue patients from the danger of impending suffocation, and to prolong life when threatened from laryngeal disease; and yet it must have struck most men, when watching cases which have been operated upon under these circumstances, how rapidly all laryngeal symptoms disappear and ulcerative action undergoes a reparative process, both in the pharynx and larynx, after a new passage has been obtained for the respiratory act, and complete quiescence of the parts has been secured by means of tracheotomy." I have a strong opinion, therefore, that it would be wise to perform the operation of tracheotomy in ulcerative laryngeal affections at an earlier period than has hitherto been practiced, with the view of arresting the progress of the disease, and probably of saving the larynx as a respiratory and vocal organ, anticipating the time when the operation may be demanded for the purpose of preventing impending suffocation. In the first volume of the "Clinical Society's Transactions" I have published some cases illustrative of these views. It should not be performed in the very early period of the disease, whilst any reasonable hope exists that by medical or local treatment a successful result may be secured; but it should be undertaken in all cases of progressive disease, when local and general treatment have failed to make any impression on the local affection.

Tumors of the Larynx are not very uncommon. Children are prone to warty growths of the rima or the parts about, and in adults epithelial tumors are likewise met with. Cancerous growths, involving the larynx, are also on record. Mr. Holmes, in his admirable work "On Children's Diseases," tells us that out of twenty-eight cases of tumor of the larynx, that he tabulated from the "Transactions of the Pathological Society," seven were cancerous. He also points out the fact that in cases of tumors of this region life is threatened by the occasional fits of spasmodic dyspnoea, the patient being often well in the intervals, and when these recur very severely, it becomes necessary to perform tracheotomy.

Indeed, when it is impossible to remove these growths from above by means of the laryngoscope, forceps, or snare, the larynx may be laid open fearlessly in the middle line, and the tumor removed. I did this not long since in a child, æt. 3, for extensive warty disease of the epiglottis and glottis, with complete success; my colleague, Mr. Durham, has done the same. I have also kept a man alive many months, with a cancerous laryngeal tumor obstructing respiration, by the operation of tracheotomy.

Tracheotomy may also be required for tumors of the neck pressing upon

the larynx. I have been called upon to operate under these circumstances on three occasions.

Bronchotomy, Tracheotomy, Laryngotomy.—Any opening made by the surgeon into the windpipe is called "*bronchotomy*;" when between the thyroid and cricoid cartilages, it is called "*laryngotomy*;" when below the cricoid into the trachea, "*tracheotomy*;" and when the incision includes the cricoid cartilage and upper rings of the trachea, it is called *laryngo-tracheotomy*. In all these operations the objects are the same, either to admit air into the lungs when some obstruction exists in or above the larynx, or to facilitate the removal of a foreign body or morbid growth. Dismissing the general term, "*bronchotomy*," from our consideration, the two latter operations claim our notice. They are applicable in two different classes of cases. When the cause of obstruction is *above* the larynx, laryngotomy may be performed; when *in* the larynx, tracheotomy or laryngo-tracheotomy should always be preferred. For the removal of a foreign body or new growth, tracheotomy is the better operation, the incision at times being extended upwards into the larynx, either through the cricoid and thyroid cartilages, or downwards as far as needed. For both operations chloroform may be safely administered, unless asphyxia be profound, when it is not needed.

Laryngotomy is not an operation to be performed on children, the cricoid-thyroid space at an early period of life being too small to allow of a free opening being made into it. It is only applicable in adults when obstruction to respiration exists above the rima glottidis, such as that caused by an impacted mass of food, or some pharyngeal growth. For tetanus or any other spasmodic affection of the larynx threatening life, it may likewise be employed, as well as in operations on the palate, pharynx, &c., in which it is advisable to insure the free passage of air into the lungs during manipulation.

FIG. 39.



To perform the operation the patient should be placed on the back, with the thorax raised, shoulders drawn down, and head extended. The operator should stand on the right side, and feel for the thyroid cartilage, for at its lower border the windpipe is to be opened. To do this, a vertical incision is to be made in the median line, about one inch long, cutting through all the tissues covering in the crico-thyroid membrane. The mem-

brane is then to be opened transversely with a knife. The crico-thyroid arteries cross this space, and may possibly be divided and give rise to some little hemorrhage. Sir W. Fergusson has recorded a case narrated to him by Professor Turner, of Edinburgh, in which a fatal hemorrhage occurred from these vessels.

Tracheotomy is by no means a simple operation. In very young children it is always troublesome; under all circumstances it is a delicate one, requiring coolness and caution. When performed hurriedly, it is too often made difficult, and even dangerous. The surgeon may at times be called upon to be rapid in his movements, but he ought never to be hurried; as the result of hurry many are the mistakes that might be enumerated, such as wounding of the innominate or carotid artery; the opening of the œsophagus through the trachea; the puncturing of the spine through both these tubes, &c.

The patient should be placed as in laryngotomy, and the surgeon stand on the right side. The different points in the neck are then to be made out, and the presence of any large vein in the line of incision looked for, and if present avoided. The best position for opening the trachea is half an inch below the cricoid cartilage, or below the isthmus of the thyroid gland; but this is not a point of so much importance as some surgeons would lead us to suppose; in infants it may be disregarded. An incision about two inches long may then be made through all the soft parts covering the trachea. This may be done rapidly when needed, deliberately when possible, care being taken at the same time not to displace the parts by means of retractors. During this step of the operation the surgeon's left index finger should be his guide; it should be steadily kept over the trachea till the rings are felt; it will also intimate the presence of any arteries near the tube or in the line of incision. The rings once recognized, the trachea may be opened with the knife, the edge being turned upwards, and the opening made parallel with the nail of the left index finger, which is in the wound. When the windpipe has been opened, air, blood, and mucus will at once bubble up. The canula, with its pilot, should then be introduced into the trachea through the opening which the left index finger has covered, the index finger acting all through as a guide and director, and, lastly, as a plug to the wound till the canula has been introduced. The eye of the operator should be at the end of his left index finger.

In opening the trachea some surgeons prefer to use the hook to draw it forward, and in some cases when much bleeding exists, or the trachea is very deep, it may be employed. I have rarely used it, having more confidence in the use of the left index finger as a guide throughout.

Some surgeons employ a dilator to keep the wound open till the tube is introduced, others prefer opening the trachea with a sharp trocar. The former practice is unnecessary, and the latter dangerous; for a sharp trocar may perforate the trachea altogether, and enter the œsophagus, an accident I have known to occur, or should it slip by the side of the windpipe the large vessels will be endangered. With respect to the canula, Fuller's bivalve has hitherto met with general approval, and may be employed, but Durham's "lobster-tail" canula (Fig. 40 and 41) is to be preferred, or the ball-and-socket instrument (Fig. 42 and 43) I have had made, the great advantage of the last two instruments consisting in the mobility of the tube with the trachea, the neck plate being fixed. The rigid tube, when required to be worn for long, too often excites ulceration of the trachea by the pressure of its free end, which may extend into the innominate artery. Every canula should be double. It should also be fixed in position by a piece of silk or tape passing round the nape of the neck. After the opera-

tion the atmosphere of the room should be kept warm and moist by the admission of steam. The wound should be kept clean; strapping and sutures are rarely required; water-dressing is probably the best local applica-

FIG. 40.

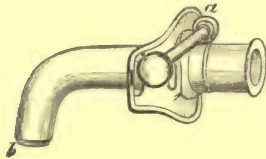


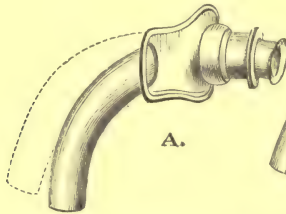
FIG. 41.



Durham's canula and pilot.

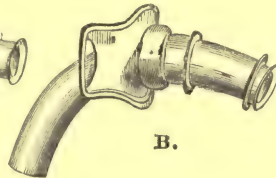
tion, or sweet oil. Great care should be observed to keep the orifice of the canula free from mucus and the inner tube clean. A piece of muslin should be placed over the tube to keep out foreign bodies.

FIG. 42.



A.

FIG. 43.



B.

Bryant's canula. A. Full length. B. Shortened.

Complications.—Should the operation be complicated by hemorrhage the surgeon is not to be alarmed. If arterial it must be arrested before the trachea is opened, either by the application of a ligature or by torsion; if venous the sooner the trachea is opened the better, for a few good inspirations do more to relieve the venous congestion, which is almost always present when tracheotomy is demanded, than any other attempt to check bleeding. As soon as the tube has been introduced the patient may be rolled over on his side, to allow the blood to run away from the tracheal wound. A piece of sponge applied over the wound with some pressure is generally enough to suppress all venous bleeding unless some large venous trunk has been opened. I have never known hemorrhage of this kind to be so copious as to interfere with the operation, or to be so persistent as not to cease readily on its completion. If the surgeon stops his operation till bleeding has ceased, he will too often wait till the necessity of the operation has passed away with the life of his patient.

Opening in the Trachea.—There can be little doubt that in patients after puberty the trachea should generally be opened below the isthmus of the thyroid. In infants and young children, where the trachea is deeply placed and the neck fat and short, this operation is a difficult if not a dangerous one; under these circumstances the nearer the opening is to the cricoid cartilage the better, and for some years I have been in the habit of opening the trachea immediately below the cricoid ring, and have never hesitated to divide it should more room be needed. In many instances I have gone through the isthmus of the thyroid, and have never had any reason to regret it; indeed, I am almost tempted to believe that the dangers

of its division are really theoretical and may practically be disregarded. Of this I am convinced that the nearer the tracheal opening is to the lower border of the cricoid ring the better is the operation. The only essential point is that it should be in the median line. If the opening be too small at the first puncture, a second should be made rather than grope about with retractors and instruments to find the original opening. The tracheal tube need not be very large, for Mr. Marsh has demonstrated ("St. Barth. Hosp. Report," vol. iii), that the cricoid cartilage is the smallest part of the air-tube, and the rima glottidis smaller than it.

Under all circumstances the operation should be completed, and even in apparently hopeless cases artificial respiration should be kept up through the wound. Mr. Holmes has recorded a case of Mr. Tatum's in which it was maintained for two hours with ultimate success.

When tracheotomy has been performed for thyroidal tumors pressing upon the trachea, the surgeon should have at hand a long perforated tube small enough to be introduced through the canula, for the tumor may so overlap the trachea as to cause obstruction below the point at which the operation is performed. For the want of such an instrument I lost a patient whom I saw with Dr. Risdon Bennett, while by its aid I was enabled to save another for several days, the elastic tube being pressed through the canula, past the obstruction, into the lungs. I have had such a tube adapted to my canula as a pilot to introduce it. It is almost needless to say that the canula should be removed from the trachea as soon as respiration by the natural passage has been re-established; that it should on no account be left in more than three months, and that if required longer a new one should be substituted, since the canula rapidly undergoes oxidation in the trachea and becomes liable to break. In a patient of my own where the tube had been worn six months close to the neck shield, half the circumference had been destroyed, and the slightest violence would have broken the instrument in the trachea.

Mr. T. Smith in an excellent paper ("Med.-Chir. Trans.," 1865) has given a good summary of the obstacles to the re-establishment of natural respiration after tracheotomy, the chief causes being a narrowing of the passage of the larynx by granulations around the canula, and the impairment or loss of those functions of the muscles of the larynx which regulate the admission of air through the rima. There may, likewise, be a persistence of the original cause which necessitated the performance of the operation, also the effects of the original disease, the closure of the vocal cords from the cicatrization of old ulceration being the most marked. In three cases now under my observation in which tracheotomy has been performed for chronic ulceration of the larynx, the rima has contracted as to be impervious in two, and in one the opening is so small as to be insufficient for respiration, although enough for speaking purposes.

To help the surgeon to judge of the patency of the glottis, Luer has invented a bullet valve to be adapted to the orifice of the canula; and Mr. T. Smith an india-rubber valve which seems an equally efficient, and is certainly a simpler instrument. Either may be employed, for anything that helps the surgeon to decide when the canula may be removed with safety is of value.

CHAPTER XXII.

SURGERY OF THE CHEST.

Contusions.—The chest is liable to be contused, and severe contusions are not infrequently followed by extensive effusions of blood ; the swelling under these circumstances occurs suddenly after the injury, and is associated with the discoloration of a bruise. These cases as a rule do well if left alone, the extravasated blood becoming absorbed. In exceptional examples the blood may break down and give rise to suppuration.

TREATMENT.—In moderate contusions the application of a cold lead lotion is all that is called for ; in more severe examples of extravasation there is nothing equal to the use of a bag of ice. In obstinate cases the application of some stimulating liniment hastens recovery, and the administration of tonics is almost always of value.

When the effused blood breaks up and suppuration ensues, the abscess must be opened, but the surgeon should never be in a hurry to interfere with these cases, nor to conclude that pus has formed, or that the effused blood is incapable of being absorbed; for it is a familiar fact that under some circumstances blood will remain fluid in the tissues for a long period and yet be eventually removed by absorption.

Rupture of the Pectoral Muscle is an accident which sometimes takes place from any forcible strain applied to the muscle when unprepared for action. I have seen it on one side nearly completely torn across about its centre from the forcible drawing back of the arm, and some effusion of blood followed; the fingers could be inserted between the divided ends of the torn muscle. The arm was brought to the side, and held there by means of a bandage, and ice was locally applied. Three months subsequently some power existed in the muscles, but the amount which is to be looked for in these cases depends upon the severity of the injury, and the care with which the parts are kept in position during the progress of repair; as a general rule the two ends of the divided muscles should be kept in contact for at least two months before movement is allowed. In children this accident is not rare from forcible dragging of the arm.

Fractured Ribs.—This accident forms about a tenth part of the cases of fracture admitted into a large hospital; it is less common in children and young adults on account of the elasticity of the ribs, than in subjects past middle age; in the old the ribs become so brittle that they break under slight external violence, and in rare cases from the violence of a cough. I have seen this in two patients between sixty and seventy years of age—one male and the other female—in whom no signs of disease existed; both are now alive.

Drs. Rogers and Brown, in the "Liverpool Med. and Surg. Rep.," 1870, tell us, "that analysis as far as it goes shows that in general paralysis the composition of the bones is changed by the proportionate increase of the organic constituents over the earthy."

The frequency of fracture of the ribs in the insane would have led us to a different conclusion. But more facts are wanted on these points before any decision can be arrived at.

In the majority of cases fracture of the ribs is the result of *direct* violence, and under these circumstances the fracture takes place at the seat of injury, and the ribs are often driven in. When from *indirect* violence, such as

that caused by a crush or squeeze, the ribs generally give way about their middle, and three or more are injured; both sides are not infrequently involved. When the bones are merely broken it is called a *simple* fracture; when complicated with a wound communicating with the fracture, *compound*; when the ends of the broken ribs are driven inwards the pleura costalis or the lung itself may be torn. The heart or pericardium or abdominal viscera are also liable to injury. In 136 cases I analyzed some years ago, when registrar at Guy's, one hundred and eight were uncomplicated fractures, of which eight only had secondary inflammation, twenty-eight were complicated, sixteen with emphysema, three with emphysema and hæmoptysis, three with extensive injury to the lung and secondary inflammatory symptoms; all of these recovered except two, that died from old-standing disease; six others died at once from fatal collapse.

When a rib is broken the serous lining of the chest, the pleura costalis, is probably injured, and the danger of the accident lies in its secondary inflammation—pleuritis. This occurred in eight of the 108 cases just alluded to. When the lung is injured as indicated by emphysema or hæmoptysis the danger of pneumonia is the one to be feared; it occurs in about seven out of every twenty-two cases. Cases that die from fatal collapse after the accident generally do so from hemorrhage due to extensive laceration of the thoracic or abdominal viscera. In gunshot fractures a portion of the ribs may be detached and driven into the lung.

Simple fracture is not a serious accident, unless it occurs in old subjects who are the victims of some chronic chest complication. The broken ribs under these circumstances render it impossible for the patients to cough up from the lungs or larger tubes the mucous secretions, and thus asphyxia is favored.

Fractures complicated with any injury to the lung are more serious; when severe, they are directly dangerous from the shock to the system, and from the hemorrhage that frequently attends them. Indirectly, they are of no less importance, as the slightest lung wound is liable to be followed by inflammation of the lung itself or of the pleura.

Fractured ribs generally unite in about one month; where they have not been kept quiet, considerable callus may be thrown out, or a false joint formed.

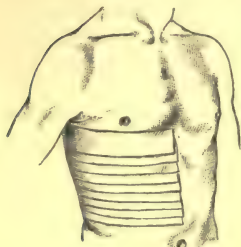
Diagnosis.—Pain in the seat of injury, associated with a peculiar catch in the breath of the patient, and the general avoidance of anything like a full inspiration, are somewhat characteristic symptoms of a fractured rib, more especially when they show themselves at once after a direct or indirect injury. At times the patient will complain of a grating in the part, and the surgeon, on the application of his hand over the seat of injury, may feel crepitus if the patient be made to cough, this crepitus being caused by the friction of the ends of the broken bone: but its detection is not constant, for when the seat of fracture is beneath a thick layer of muscles or fat it may escape notice; nor, indeed, should it be too closely sought after when other symptoms indicate the nature of the injury, for the manipulation required to elicit this sign is sometimes difficult, and any approach to violence or over-manipulation is always injurious.

When **emphysema** complicates the case, there is no doubt as to the lung having been injured, for the more or less diffused puffy swelling which crackles on pressure is caused by the escape of air from the lung into the cellular tissue about the seat of fracture. It may be only local; in rare cases it becomes general; when associated with *hæmoptysis*, it is fair to infer that the lung has been penetrated, the extent of the emphysema and

amount of the hæmoptysis being a tolerably sound guide as to the severity of the visceral injury.

TREATMENT.—The object of the surgeon in the treatment of a simple fracture of the thorax is to maintain the ribs at rest, and this is most efficiently carried out by the application of strips of strong adhesive plaster

FIG. 44.



two inches broad, extending from the sternum to the spine; the plaster covering in the seat of injury, and at least three inches above and below it; each strip should be so applied as to cover the half of the one that preceded it. By this method the movements of the broken ribs are restrained without interfering in any way with those of the opposite side. It is far superior, both in comfort and efficiency, to the old method of encircling the chest with a flannel roller, and ought always to be employed; indeed, it generally affords speedy relief to all symptoms. When the case is complicated with emphysema or even hæmoptysis the same treatment should be carried out, for in these more severe cases the necessity of maintaining the immobility of the ribs is just as necessary as it is in the less severe.

In rare cases in which much displacement has occurred, a sheet of felt or gutta percha made soft by hot water and moulded to the part is of great value, the mould being subsequently fixed by strapping as before.

The patient should be kept quiet, although not necessarily in bed; abundance of bland, nutritious, but unstimulating food should be given, and sedatives, if required; of these chloral in half-drachm doses is probably the best; morphia or Dover's powder are also good. Should cough or any symptoms of inflammation of the pleura or lungs appear, antimony in the form of antimonial wine in doses of thirty minims for the adult, every four or six hours, in some saline mixture, is a most valuable remedy; it is required, however, but in exceptional cases; local treatment was alone required in 100 of the 136 cases above mentioned. When chest complications are severe, and orthopnoea with suffocation from pulmonary congestion threaten life, venesection becomes a most valuable remedy.

In a case that passed under my care some time ago of severe injury to the chest caused by the passage over it of the wheels of a heavily laden cart, fracture of five or six ribs occurred, associated with dislocation of the clavicle, collapse, intense dyspnoea, and hæmoptysis; I bled the patient twice in twelve hours, each time with immediate relief and the case went on to a good recovery. In it the severe dyspnoea and congestion of the veins, the rapid and hard pulse that came on as soon as the collapse of the accident had passed away and the circulation had been restored, too surely pointed to an excessive engorgement of the lungs, and indicated that if relief was not afforded, absolute suffocation by the patient's own blood would speedily ensue; at such a crisis antimony, however beneficial in simpler cases, could not alone be trusted; there was no time for it to take effect before the mechanical process of suffocation would have done its worst, and death must almost necessarily have followed. Under such circumstances bleeding was performed, a free incision was made in the vein, and, as the blood flowed, life seemed gradually to return. The breathing, from being an act of labor, became quiet and subdued; the eye, from being deadened and congested, became bright and natural; the pulse, from being full and hard, became softer and less bounding; and the boy's feelings, equally valuable in their indications, released from the impression that

death was nigh at hand, became more hopeful and resigned; and, as a spectator, I felt that such a hope was valid, and that success might crown our practice. The relief which such treatment afforded at the onset was not to be despised when like symptoms returned; and the repetition of the bleeding was followed by a repetition of all its benefits. The antimony then came in to complete the cure; a blow had been struck by the double venesection; the pulmonary vessels had been relieved of their congestion, and the antimony had now succeeded in acting upon the circulation, and had thus, by preventing a return of the former threatening symptoms, perfected the cure. This case, and the practice which has been illustrated by it, have such a firm hold of my mind, from the subsequent careful watching of many similar instances, that I cannot too strongly recommend the general adoption of a like treatment.

Bleeding is now rarely performed; indeed, I believe that at Guy's Hospital it is rarer than any capital operation. In these cases of lacerated lung, however, when urgent dyspnoea makes its appearance, and the powers of the patient do not forbid it, I know of nothing which affords equal benefit, and which to the patient gives greater relief or to the practitioner greater pleasure. Bleed with no sparing hand; let the blood flow freely in a full stream, and as it flows the symptoms will gradually disappear. When relief has been obtained, immediately arrest the flow. Your aim has been to make an impression through the systemic circulation upon the pulmonary, and syncope can only do harm. Watch your patient carefully, and repeat the operation if the symptoms should return, and, if necessary, repeat it a third time. The antimonial treatment, however, must not be neglected. The bleeding is really to relieve immediate symptoms, and to give time for the antimony to take effect; when the patient has been brought fully under its influence, the danger may be said to have disappeared, as few patients die from secondary inflammation of the lungs when once fairly under the influence of antimony.

The application of the principle of bleeding in these cases well bears out Sir Thomas Watson's views when he wrote:

"The condition which cries out for and obtains relief so signal and immediate from phlebotomy, may be described as that of great and often sudden engorgement and distension of the vessels that carry black blood, of the systemic veins, of the pulmonary artery, and especially of the right chambers of the heart. In this embarrassed condition of the circulation, with so unequal a distribution of blood in the two different systems of vessels, it is the veins that require emptying, not the arteries. As the tension of the stretched and almost paralyzed right ventricle is lessened, the hollow muscle again becomes capable of contracting upon and expelling its contents, the clogged lung is set free, the functions of the oppressed brain are eased and relieved, and the balanced play of the heart and lungs is restored. This, it seems to me, is the true philosophy of bloodletting in disease, approved by reason and fortified by experience" ("Practice of Physic," Ed. 5th).

Fracture of the Sterno-costal Cartilages is a rare accident; I have seen but one case, and in that a false joint existed; it was of the seventh rib and had resulted from a direct blow. These cases are said to unite generally by bone; and they are to be treated as a case of fractured ribs.

Dislocation and Fracture of the Sternum are likewise rare, the majority of cases are complicated with other injuries, those of the head and spine being the most common. It was found in four out of fifty-six fatal cases of injury to the spine at Guy's Hospital, and as a complication of fractured ribs, it is occasionally met with. When deformity is present from displace-

ment of bones, the diagnosis is easy, and when this does not exist, pain in the part aggravated by a full inspiration, and crepitus on the application of the hand, are the chief symptoms. The *treatment* will be the same as for fractured ribs, such as the recumbent position and strapping over the part, complications being dealt with as they arise.

Dislocation of the Ribs requires notice, although little can be said about the subject. It is rarely if ever an accident *per se*, and when it occurs it is part of a more severe one, such as fracture of the spine, or complicated fracture of the ribs. The same remarks are applicable to dislocation of the *ribs from the cartilages*, and the *cartilages from the sternum*. Practically all these cases are to be dealt with like fractures.

Wounds of the Chest.—When a surgeon is called to such a case the main point he has to determine is whether the wound be superficial or has penetrated the pleura. If the former, all cause for anxiety has ceased; if the latter, the accident is a grave one.

When it can be made out that the wound is a *penetrating one*, the surgeon has to determine the extent of the penetration, and the organ penetrated; is the pleura alone wounded—a rare injury—or is the lung involved? Is the heart injured or any of the great vessels, the intercostal or internal mammary? Many of these points can be determined only by a knowledge of the kind of weapon employed, its subsequent appearance, the direction of the force, and the anatomical knowledge of the surgeon; even then the difficulties of these cases are often great, as witnessed in a recent memorable trial. Emphysema and hæmoptysis when present are tolerably clear indications of a wounded lung. Emphysema alone is a suspicious symptom; but it may occur to a limited extent in punctured non-penetrating wounds that traverse the soft tissues outside the thorax; the absence of hæmoptysis is no proof that the lung has escaped injury. When blood and air bubble through the wound, when air passes freely from it, or a portion of lung protrudes, there is no room for doubt as to the nature of the injury; but these cases are exceptional. In the majority, the diagnosis is ever uncertain, for there are no definite individual symptoms by which injury to the lung is to be diagnosed. The surgeon in his anxiety to make out the point must never be induced to examine the case too closely, that, is, he must on no account be tempted to probe the wound, or to explore it with a finger; he should never test the condition of the lung by making his patient cough to expel air through the thoracic opening; indeed, he should throw aside all direct or manipulative modes of investigation, and trust to the indirect or reasonable, for all other modes are unwarrantable.

The direct effects of a penetrating wound are various. Hemorrhage into the chest or hæmothorax, emphysema, pneumothorax, and hernia of the lung are the chief. The secondary results are those of inflammation, such as pleurisy or pneumonia, hydrothorax, or empyema with their consequences.

The *prognosis* is always unfavorable when the wound is a penetrating one, and in all it should be guarded; when a week passes and no unfavorable symptoms show themselves a more promising and decided tone may be assumed.

TREATMENT.—In suspected or obvious penetrating chest wounds, under all circumstances, the utmost gentleness must be employed, and the most complete quiet enforced; for any deviation from this practice may disturb nature's reparative process, disarrange clot, and excite overaction or inflammation. The external wound should be carefully *cleaned and closed*, all foreign bodies being as a rule removed. The patient should be placed in the recumbent position, and on no account be allowed to stir; he should

be fed upon the simplest nutritious food, and for the first two or three days it should be cold, ice and milk being without doubt the best mixture. Collapse which often follows the injury need not excite alarm, unless protracted or severe, and when the result of hemorrhage it is in a measure salutary; indeed, it is the only means the surgeon looks to for the arrest of hemorrhage; for he himself is powerless to interfere. Should blood accumulate in the chest and mechanically threaten life, some means must be found for its evacuation, either through the original wound or by the operation of tapping, or incision of the thorax; but the indications must be very decided before the surgeon should interfere, the extravasated blood rapidly coagulating, and thus being difficult to remove, and the same remarks hold good when air accumulates or is pent up in the pleural cavity.

The symptoms that attend reaction should be carefully watched and controlled; anything like excess of action as indicated by increase of difficulty in respiration, cough, or a rapid pulse, must be met by the administration of antimony, half-drachm doses of the wine every three or four hours in some saline being the best form.

Should the patient's lungs become gorged with blood and asphyxia threaten, venesection is as valuable a remedy in these cases as it has been shown to be in similar ones caused by fractured ribs. Dr. Macleod tells us that the cases of gunshot wounds of the chest that did the best in the Crimea were those in which early and repeated bleedings were had recourse to. Pain must be relieved by anodynes, chloral being better than opium, but this or any of its class must be given when needed.

Hernia of the Lung or Pneumocoele is a rare consequence of a punctured wound of the thorax. I have seen but a single example of such an accident: the tumor was on the left side external to the nipple, and was about the size of a walnut; it gradually withered up, as it was not deemed necessary to return it. When the hernia is recent and the lung healthy its reduction is generally considered to be the best practice, when of long standing and diseased it had better be left alone; some surgeons advise its removal by ligature or the knife, successful cases having been recorded of both forms of practice.

Velpeau has recorded an instance of hernia of the lung coming on as the result, but after the healing of a wound; this is called the consecutive variety of hernia. The tumor in such a case is covered with integument. Nothing can be done for such a case, but to protect the lung from injury by a shield.

Laceration of the Lung without Fracture of the Ribs is an accident of occasional occurrence. I recorded such an instance in the "Guy's Reports" for 1860; it was doubtless caused by extreme pressure upon the elastic ribs of a boy *æt.* 7. Poland, also, in his excellent article on the chest in "Holmes's Surgery," has quoted several others. The explanation of M. Gosselin is probably the correct one as to its cause, "that at the time of the injury, when the chest sustains the violence, the lungs are suddenly filled and distended with air by a full inspiration, and the air, prevented from escaping by occlusion of the larynx, thus becomes pent up in the lung-tissue, and the lung, not being able to recede from the superincumbent pressure, its tissue necessarily gives way." The symptoms of this injury are much the same as have been mentioned in the paragraph on wounds of the lung, and the treatment must be similar.

Severe Compression of the Chest may likewise cause brain symptoms, such as unconsciousness, epistaxis, and hemorrhage beneath the conjunctiva and eyelids; and in a singular case which I recorded in the same volume

of the "Guy's Rep." as that of the boy just quoted, paralysis of the muscles of deglutition and of the larynx was produced, which lasted for two days after such an injury.

Abscesses are frequently found about the chest, and when situated beneath the pectoral muscles, they are very obstinate; they may be confined to the cellular tissue of the part, and connected with the subpectoral glands, or associated with ruptured muscle or inflammation of the periosteum or bone.

Abscesses connected with the muscles must be opened and the parts kept quiet by binding the arm to which the muscle belongs to the side, for each movement of the muscle retards recovery.

When due to *periostitis* or *ostitis*, they are more commonly situated over the sternum, but any of the ribs may be affected. They are also very frequently due to syphilis. Under these circumstances, constitutional treatment is essential, the iodide of potassium, from five to ten grains, in some tonic such as bark, being the best medicine. Should the bone die—**necrosis**—the dead portion must be removed, should nature prove herself incompetent to throw off the *sequestrum*.

When sinuses exist about the thorax the surgeon should always be alive to the fact that they may be due to an *empyema*, which has naturally discharged itself, or to a *substernal abscess* making its way through the intercostal spaces. The history of the case will provide the only correct clue to the diagnosis. In both instances a free opening into the abscess is called for, its cavity being washed out.

Tumors of the Chest are not uncommon, but they come more under the notice of the physician. I have seen, however, several cases of exostosis from the ribs and one of enchondroma. No surgical interference was called for.

Deformities of the chest are mostly due to spinal curvatures. The contracted or compressed thorax with the projecting sternum of childhood—pigeon breast—is frequently found where some long-continued obstruction to natural respiration exists; it is not a permanent one in a large number of cases, children who are the subjects of it "growing out" of the deformity as their general condition improves and powers strengthen.

It is commonly found in rickety subjects, and is thought by some surgeons to be the result of enlarged tonsils; it is probable, however, that the enlarged tonsils and deformity are accidental associates. Deformity of the chest may be due to an old pleurisy.

Tapping the Chest.—When air, blood, serum, or pus, singly or combined, accumulate in the chest, and by their pressure threaten life by asphyxia, the operation of *paracentesis thoracis* may be called for, or some other means adopted for relieving the symptoms. When *pneumothorax*, whether as a consequence of disease or accident, causes pressure on the lung and interferes with the respiratory process so as to create alarm, the tapping of the chest with a small trocar and canula fitted with a valve, is the right operation. Blood sometimes accumulates in the chest—*hæmothorax*—producing similar alarming symptoms; this blood is mixed with air, and when it is clear to the surgeon that life will be extinguished if relief be not afforded, it must be let out: to do this with a trocar and canula is always a difficult task, and often an impossible one, on account of the coagulum, and it is probably a better operation to make an incision into the thorax where no wound previously existed, or to enlarge a small one when present. The object of the surgeon is to remove the pressure by the withdrawal of the compressing material, blood, serum and air, and this can only be effectually done by making a free opening. When *serum* presses

upon the thoracic contents—*hydrothorax*—and requires surgical interference, the trocar and canula are without doubt the best instruments to employ, and the smaller the better, great care being observed to exclude air. When pus exists—*empyema*—surgeons are not quite decided as to the best means to be employed. The trocar and canula are probably most generally used, but the results of this practice are not satisfactory. The pus may be drawn off partially, but some remains, and a rapid reaccumulation as a rule takes place, and often decomposition. Other surgeons have employed the drainage-tube in different ways, and with good success. For my own part I think there can be little doubt that when pus so presses upon the lungs and interferes with the respiratory process as to call for surgical interference, the pus must be let out, and that the only efficient plan is by means of a free opening; the opening should be large enough to permit of the free escape of all fluid, and also of air should it enter. The admission of air into a suppurating cavity, and its retention will almost certainly end in decomposition, but when the free escape of pus and air are permitted such a consequence is rarely met with. The introduction of drainage-tubes by M. Chassaignac has consequently been of great service in the treatment of empyema. Dr. Goodfellow and Mr. De Morgan have been their chief advocates in this country, the latter surgeon passing the perforated india-rubber tube through the canula upon a long iron probe, and bringing it out of a second opening in the lower and posterior part of the chest, made upon the extremity of the probe with a scalpel, the end being pressed against the lower intercostal space as a guide to the surgeon. The perforated tube consequently passes as a seton through the chest and allows the free escape of any fluid in its cavity. This operation has, however, its dangers. My friend Dr. Sutton has recently related to me a case in which it was performed for empyema and pneumothorax, and a few days following emphysema appeared about the wound, which spread over the whole body and destroyed life.

I have never adopted this practice in the way here detailed, having been well satisfied with a free opening into the thorax, either with a scalpel or large trocar and canula, introducing subsequently the drainage-tube into the thorax, or an elastic catheter. In two cases I daily washed out its cavity with a good result. I have had every reason to be well pleased with the practice indicated, its essence consisting in a free vent for all pent-up material.

To tap the chest the following points should be observed. The sixth or seventh intercostal space is the best to select, and midway between the sternum and spine is the best point. This spot can always readily be found by drawing a line with a string round the body on the level of the nipple, and midway between the sternum and spine this line will cut the proper intercostal space; at this spot close to the lower rib a small incision should be made through the skin and fascia with a lancet or scalpel, and through this the trocar and canula, warmed and oiled, are to be introduced; the trocar as soon as it has perforated the chest should be withdrawn, the canula being pushed more home.

When the operation has been performed for air or serum a small instrument should be employed, and great care used to prevent the admission of air. For this purpose there is no better instrument than the pneumatic aspirator of Dr. Dieulafoy, or one of its modifications. As a substitute one of the canulas fitted with a stop-cock or valve to prevent the admission of air may be used.

When the chest requires opening for the discharge of blood or pus, it has been already said that a free incision or large canula should be used.

Trousseau strongly advises the operation of tapping to be performed when serous effusion fills the cavity, as indicated by auscultation and percussion; when oppression of breathing also exists it has an important signification, but this oppression he says is one of the most deceitful of signs, and its absence ought not to inspire too great a feeling of security; for by refraining from interference we run the risk of losing patients, whom the operation would assuredly have saved. In empyema he fixes in the canula and draws off the fluid every twenty-four hours, injecting the chest with a solution of iodine, one part of the tincture in six every two, three, or four days.

Apnoea, or so-called Asphyxia.—Death from asphyxia, in the common acceptance of the term, means death from either the cessation of the respiratory process or the want of the ordinary respiratory medium—oxygen—the heart ceasing to act after the respiratory process. Etymologically it means an absence of pulse. The more correct term is doubtless apnoea. It is caused by whatever interferes with the admission of air into the lung, by such acts as *drowning* or *hanging*; by diseases that mechanically block up the air-passages, or excite spasm of the larynx; by any external or internal condition of the thorax that prevents the admission of air into its cavity or interferes with its expansion; by the want of the respiratory medium, or by the inhalation of toxic vapors.

In some of these circumstances the asphyxia is rapid or acute, in others chronic. In accidental cases it is chiefly rapid; in diseases, slow. In both, however, the result is the same, the blood is not decarbonized as it should be, and what Dr. Cleveland has rightly called carbonæmia ensues. Special symptoms may depend entirely upon the nature of the asphyxiating cause, but the ultimate effects are the same in each. In all, whether slow or rapid, there is congestion and lividity of the face, and in all, the heart continues to beat, although laboriously, after respiration has ceased, the action becoming gradually less distinct till it stops, it being possible for the heart to continue its action from two to four minutes after the last respiratory effort.

After death, it has generally been thought, the *cerebral vessels* would be found gorged with blood. Ackeman has, however, fairly shown that this condition is present only when the head of the subject has been kept lower than the rest of the body, and that death by suffocation is always connected with an exsanguine state of the cerebral vessels.

The *heart and great vessels* on the *right* side will be full of black blood, whilst the *left* side will be found empty. The whole arterial blood will be, as the venous, of a dark color. All the abdominal viscera will be engorged with blood.

The *lungs* in all cases, when the respiratory orifice is plugged, as in hanging and in other cases of mechanical obstruction, will present no characteristic appearance. But in cases of drowning they will be found more or less filled with water or the drowning medium. They will feel doughy to the touch, and heavy, being incapable of collapsing. The air-tubes will be choked with a sanious foam composed of blood, water, and mucus, churned up with the air of the lungs, and often with foreign matter. Frothy water mixed with blood will pour out of any section of the lung. These points were made out by the Committee of the Med.-Chir. Society on suspended animation, and recorded in the "Transactions" for 1862.

Drowning.—*How long may a human being be under water, and yet recover?* is an important question, and it turns upon many points. Dr. Sanderson believes that he has demonstrated by experiments that in animals the duration of life turns upon the amount of air confined in the chest at the time of immersion. When the animal fills its chest with water by an inspiratory effort on immersion, death is most rapid; but if the chest be full

of air at the time, and no such inspiratory effort takes place, life may be prolonged for several minutes. From this fact the occurrence of syncope at the moment of immersion is a happy accident, whether from the fright, shock, or previous injury, the respiratory act being materially diminished by the syncope. "If a person be completely submerged," writes Dr. G. Harley, in "Holmes's System," "and the entrances of water to, and exit of air from the lungs not prevented, we believe that recovery would be impossible after two minutes. On the other hand, if the air-passages were closed against the entrance of water, and the chest kept full of air, we see no reason for thinking that a human being would perish either more slowly or more quickly than a dog placed under similar circumstances, namely, in from four to five minutes."

Hanging causes death, according to Dr. A. Taylor, "commonly from apnœa, but sometimes from apoplexy, caused by pressure on the jugular vein being preceded by convulsions, often lasting for many minutes, but in all probability not accompanied by more than momentary pain. Occasionally there is found displacement or fracture of the first or second of the vertebræ, with compression of the spinal marrow. This cause of death is only likely to be observed in corpulent or heavy persons, when a long fall is allowed by the cord, and is seldom met with in judicial executions." This latter fact is supported by the observations of Dr. Barker, of Melbourne, who informed Professor Haughton, of Dublin, that in fifty post-mortem examinations of criminals hanged according to the old or "short-drop" system, in not a single case was there dislocation or fracture of the neck. In the plan introduced by Dr. Barker this dislocation was the rule. Dr. Haughton quotes his words ("Med. Times and Gaz.," June 21st, 1871): "I have the knot put about two inches from the spine, so that when it is tightened by the weight of the body the knot comes on the vertebræ; by the fall the body has an impetus forwards, the resistance being at the beam to which the rope is fastened. The knot acts as a fulcrum to push the head forwards. By this arrangement, I have found in all cases there was a dislocation and fracture of the cervical spine and pressure on the cord, laceration of the muscles of the larynx, and generally fracture of the hyoid bone; death being always sudden and complete, no long-drop is required." To the Irish and American long-drop system there are grave objections. When the cord is crushed death is instantaneous; when not so injured life may be prolonged for minutes, usually about three; but there is evidence to make us believe that the period may be extended to ten. Conscious life, however, probably under both circumstances, is soon lost, rarely extending beyond the *three* minutes.

When the cord is not injured, Taylor computes that life may be restored after five minutes of suspension, and Tardieu, an eminent French writer, gives the same period.

TREATMENT OF APNŒA OR ASPHYXIA.—Drawn up from Harley's rules as given in "Holmes's System," and the recommendations of the Med.-Chir. Society "Trans.," 1862.

1. All obstruction to the passage of fresh air to and from the lungs is to be at once, so far as practicable, removed; all froth and mucus to be cleansed from the mouth and nostrils; and should the case be one of drowning, the legs and trunk of the patient are to be raised for a few seconds above the head and shoulders to allow of the exit from the lungs of any fluid that may be present in them.

2. All tight articles of clothing are to be at once taken away from the neck and chest, and in the absence of natural respiration artificial respiration by Dr. Silvester's plan is to be forthwith employed as follows:

Silvester's Method.—The body being laid on its back (either on a flat surface, or better, on a plane inclined a little from the feet upwards), a firm cushion or some similar support should be placed under the shoulders, the head being kept in a line with the trunk. The tongue should be drawn forward so as to project a little from the side of the mouth; then the arms should be drawn upwards until they nearly meet above the head, the operator grasping them just above the elbows, and then at once lowered and replaced at the side. This should be immediately followed by moderate pressure with both hands upon the lower part of the sternum. This process is to be repeated about twelve or fourteen times in the minute.

3. As soon as natural respiratory movements recommence, cease the employment of artificial means, unless the efforts are feeble and imperfect. Should no natural respiration supervene, a dash of hot water, 120° F., or cold water may be used.

4. Maintain the temperature of the body by friction, warm blankets, and when possible by warm water (106° F.), or air bath, keeping the head where a circulation of pure air may be maintained.

5. As soon as the patient can swallow give warm milk, beef tea, tea or coffee, with a tablespoonful of some spirit, or these may be injected by the stomach-pump.

6. When respiration is restored put the patient into a warm bed, with hot bottles to his feet, and encourage sleep, but let him be watched in case of secondary or relapsing apnea; and at the slightest symptoms of which let friction and even artificial respiration be re-employed. Give volatile stimulants such as the *spiritus ammoniæ aromaticus*.

SURGERY OF THE CIRCULATORY SYSTEM.

CHAPTER XXIII.

WOUNDS OF THE HEART AND ARTERIES—HEMORRHAGE AND ITS TREATMENT.

ALTHOUGH it is quite possible for the anterior mediastinum to be traversed from side to side by a foreign body without any important structure being wounded, it is far more common for some severe lesion to be the result, such as a wound of the pericardium, heart, lung or great vessels. A wound of the *pericardium alone* may occur, and not prove fatal. Dr. G. Fischer has collected fifty-two reputed cases of the kind, twenty-two of which recovered, including punctured, incised, gunshot, and lacerated wounds. The chief danger of this local injury lies in secondary inflammation of the membrane.

Wounds of the heart itself are generally mortal, death taking place immediately in about one-fourth of the cases; in the bulk of the remainder after a few days; rare instances recovering. The symptoms of a wound of the heart are very uncertain, but the most important, says Poland, "is the

presence of a *lesion* in the neighborhood of the heart, with *external bleeding*, followed by all the signs of sudden internal hemorrhage." Sudden *collapse* is a very general consequence of the injury, and when it comes on some time afterwards, it is probably due to secondary hemorrhage, from the giving way of the clot in the wounded heart. *Dyspnœa*, according to Fischer's Analysis, is not constant, and when it appears it seems to be due to the compression of the heart by the effusion of blood into the pericardium and pleura. In some cases it is immediate and intense. The *pulse* is often unequal, small, and intermitting. *Pain* is uncertain. The position of the external wound is a valuable aid to diagnosis, and it is well to remember that the sternal end of the second left intercostal space corresponds to the left base of the heart, and the lower margin of the fifth rib to the apex. In a medico-legal sense it should also be known that "when a person is found dead with a wound in the heart, attended with abundant hemorrhage, it must not be supposed that the flow of blood took place in an instant, or that the person died immediately, and was utterly incapable of exercising any power" (Taylor). The symptoms as well as the duration of life are much influenced by the direction and size of the wound. Thus, if made in the course of the muscular fibres there will be little or no hemorrhage, and consequently less collapse, dyspnœa, &c., &c.; but if the heart be cut across, the edges will separate to a great extent, and sudden death occur from the immediate gush of blood. In oblique wounds there will be less gaping of the edges. With respect to the cases of recovery, Sanson has recorded an instance in which a cicatrix in the heart was found some lengthened period after a wound, from which the patient had recovered in twenty-eight days. Velpeau has cited a second, of a man aged fifty, who died nine years after having received a wound in the left side of the chest from a table knife, and in whom the pericardium was found largely opened and adherent to the parietal cicatrix, and fibrous lines traversed the whole thickness of the right auricle, at a point corresponding to the breach of surface in the pericardium. The heart may also be lacerated by a severe contusion or pressure upon the chest without external wound or fracture of the ribs.—(A preparation in the Royal College of Surgeons of Edinburgh proves this point.)—The diagnosis and treatment of this form of injury are the same as in cases of wounds.

TREATMENT.—As hemorrhage is the main fear, so to prevent and arrest it should be the surgeon's chief aim. To do this, absolute repose is essential, and this should be maintained for many weeks. The local and general employment of cold should likewise be used. To calm the excited action of the heart belladonna and digitalis have been recommended, and so even has venesection. When the pericardium is full of blood, it has been suggested to lay open the cavity to let it out, but the uncertainty of diagnosis is sufficient to forbid the attempt. The diet should be nutritious, but unstimulating. For further information on this subject I may refer to Poland's article in "Holmes's Surgery," which contains an admirable analysis of Fischer's paper; also, paper by West, "St. Thomas's Hosp. Rep.," 1870.

Wounds of the large vessels of the chest are generally fatal, death being, in most cases, immediate from internal hemorrhage. Dr. Heil, however, records a case in which a man recovered, and lived a year after receiving a stab which penetrated the aorta. Pelletan also cites another, in which a man was run through with a foil, which entered the chest above the right nipple, and came out at the left loin. No violent or marked symptoms followed beyond constant pain in the loins. Two months later he died somewhat suddenly, in great agony, from hemorrhage into the right side of

his chest, and after death, an opening the size of a quill was found in the aorta above the diaphragm. The Hunterian Museum (No. 1565a), contains a specimen of the ascending aorta of a sailor, in which was lodged a bullet in a piece of integument surrounded by lymph. The man lived three days after receiving the wound, which was produced by a musket-ball passing through the diaphragm and pericardium into the aorta. It entered the chest between the eighth and ninth ribs, and was followed by a rush of blood. Very soon, however, all hemorrhage ceased.

On Wounds of Arteries.—When an artery is *completely cut across* bleeding takes place, the blood jetting forth *per saltum*, as it is called, with each pulsation of the heart. The blood is usually red and frothy, unless the patient be asphyxiated, or fully under the influence of chloroform, when it is often as black as venous blood. Pressure upon the vessel above the wound arrests or diminishes the hemorrhage, and pulsation in the vessel below is lost. When, however, an artery is *only partially wounded*, either transversely, obliquely, or longitudinally, bleeding will still take place, though it will probably be less profuse; the blood rarely jetting out as from a divided vessel, unless the wound be very large, but welling up *in a deep wound*, or flowing out in a continuous stream, after the manner of venous blood. When red its arterial nature can be readily recognized, but when black its recognition is more difficult; should pressure above the wound arrest the flow and pulsation in the vessel below be lost, the probabilities of the blood being arterial are strengthened. It must be remembered, however, that when a large artery is partially divided just *below* a large anastomotic branch, bleeding will take place from the lower end of the wounded artery as well as from the upper, while pulsation in the vessel below will only be diminished. This is an important fact to bear in mind.

When hemorrhage takes place from a large vessel it is generally so profuse as to destroy life rapidly unless instantly checked. When from a small one it is less copious, and has a natural tendency to stop, at any rate for a time, and to give an opportunity for natural hæmostatics to take effect. It will be well, therefore, to consider how wounded arteries heal, and by what means bleeding is naturally arrested.

Small wounds of arteries may, doubtless, heal by immediate union or primary adhesion, and larger ones may likewise for a time be closed by the clot of blood that covers the wound, or even by some stronger reparative material; but "the closure is often ineffectual, or only for a time, and fresh bleedings ensue, either increasing the accumulation of extravasated blood or pushing out the clots already formed. In this way, with repeated hemorrhages at uncertain intervals, the wound in an artery is often kept open, and at the end of two or three weeks may show no trace of healing, but rather appear widened and with softened everted edges. In such a case it is possible that the wound in an artery may still *heal by granulations*, either rising from its edges or coalescing over it from adjacent parts; but the event is too unlikely to justify the waiting for its occurrence, if there be opportunity for surgical interference, and even if healing should go so far as to close the opening in the artery yet it is likely to be insecure, for both the elastic tissue and smooth fibred muscle, on which its strength largely depends, are very slowly formed in scars. Hence a form of traumatic aneurism seems not very rare, in which the sac is chiefly formed of scar-tissue, which closed the wound in the artery and then yielded to the pressure of the blood" (Paget, "Lectures," p. 204, ed. 3d).

Hence partially divided arteries are more serious than those completely divided, and they require as prompt surgical treatment; for the means adopted by nature for the permanent arrest of bleeding in a divided vessel

are acting at a disadvantage in one only wounded and are rarely effectual; thus in practice it is often the object of the surgeon to complete the division of a partly divided vessel, and give natural hæmostatics a fair chance of effecting a cure. From vessels of small size hemorrhage, as a rule, ceases after the first rush, or at any rate, as soon as nature's processes for controlling bleeding have had time to act. Indeed, "gradually, with or without surgical help, all the vessels divided by a wound are closed and cease to bleed; the larger being often aided to this end by their retraction among the looser textures, and by the coagulation of the blood within or over their orifices, and by the diminution of the heart's force with the increasing loss of blood. Coincidentally the flowing blood becomes gradually brighter and paler. And if the wound be left open after pure blood has ceased to flow, there is an oozing of blood-tinged serous-looking fluid; and this is gradually succeeded by a paler fluid, some of which collects like a whitish film on the surface of the wound" (Paget).

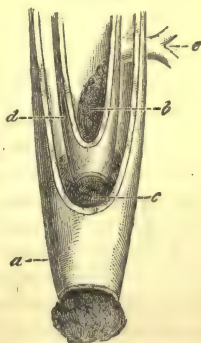
Whatever favors retraction of a divided artery and its contraction, tends to arrest bleeding; whatever hinders these processes prolongs and increases it. Thus vessels that traverse loose textures cease bleeding more readily than others circulating through those that are close and compact, such as the integument of the head, and sole of the foot, and bleeding from an inflamed part or rapidly growing tissue is checked with greater difficulty than from parts differently situated.

The size and form of the wound in the vessel has also much to do with the result. A *puncture in the axis* of a large artery may heal by natural processes, and be unattended by much bleeding. A small *vertical* wound may likewise close. An *oblique* wound will gape and is, consequently, attended with copious bleeding, while a *transverse* wound is of all others the most dangerous on account of the difficulty of controlling hemorrhage and the improbability of natural hæmostatics unassisted by art acting with any permanent advantage. The retraction power of the vessel tends to cause gaping of the wound rather than closure, and encourages rather than checks bleeding.

Natural Hæmostatics.—When an artery is divided across five things happen. (1.) The divided ends (Fig. 45 *d*) retract within the sheath, and (2) contracting diminish the calibre of the canal. (3.) Blood coagulates *in the sheath* (*a*) around the orifice of the divided vessel; and (4) *in the artery* itself (*b*) up to the first large branch; and, lastly (5), *plastic lymph* is poured out from the divided coats of the vessel, and by its organization the permanent closure of the vessel takes place. The clot subsequently becomes organized and the vessel contracts. In a large proportion of the cases of divided arteries these natural hæmostatic processes are ample of themselves for the arrest of bleeding; and it is only in the larger arteries that any surgical or artificial aids are required. These to be good must be based on the self-same processes, and are to be looked upon simply as aids in giving time for the physiological methods to take effect; in so far only as they aid and do not interfere with the due action of these is the value of the surgical interference to be estimated.

Thus the *exposure of, and the application of cold to*, a divided artery favor its contraction: this physiological fact explains the practical one,—that on the free opening of a wound, hemorrhage so often ceases never to return.

FIG. 45.



Pressure upon the end of a wounded artery favors coagulation in the vessel,—the value of *acupressure* rests mainly upon this principle,—the pins mechanically arresting the flow of blood, whilst coagulation is taking place in the vessel up to the first branch. The application of a *ligature* is based upon the same kind of knowledge as well as the practice of torsion. It will be well, therefore, to consider briefly how these artificial means act.

To Stilling and Dr. J. F. D. Jones we are indebted for most of our knowledge upon these points. When a *ligature* is applied to an artery the inner coats are usually more or less regularly divided, and the outer coat is so constricted as to arrest the current of blood through the vessel. The blood that is arrested consequently coagulates and forms a clot, or thrombus, which is, as a rule, conical with its base towards the ligature, and apex pointing to and reaching the first branch. (Fig. 46*b*). This clot subsequently contracts and becomes organized. The inner and middle coats pour out plastic lymph round about the line of their division by the ligature (*c*), which heals the wound, and cements the outer coat, inner coat, and clot together into one homogeneous mass. The outer coat, constricted by the ligature, sloughs or ulcerates through, allowing the ligature to be removed, and it is this action that too often tends to undo what nature had otherwise well done by the processes above described, and gives rise to secondary hemorrhage. In this point rests the weakness of the practice of arresting hemorrhage by means of the ligature.

FIG. 46.



When an artery is closed by what is termed *Torsion* the inner coats are ruptured (Figs. 47 and 48 *B* and *C*), and the outer coat (*A*) closed by the twists to which it has been subjected when not twisted off. But the inner coats, instead of being simply divided in a linear manner, such as occurs in the ligature, are ruptured, separated from the outer coat, and incurved, their divided ends turning into the vessel, and in the most perfect examples forming complete valves, not unlike the semilunar valves of the heart.

The blood, which is consequently arrested by this valvular incurvation of the inner tunic, undergoes changes precisely similar to those already described.

Plastic lymph is poured out by the divided tunics in the same way as it has been shown to be in the application of the ligature, and it acts the same part in cementing all the arterial tunics and clot together; but there is this difference between the two forms of practice, that where the ligature has been used, the ulceration of the vessel that is necessary to allow of its escape may undo all that nature has done to seal the artery and prevent hemorrhage; whereas, when torsion has been efficiently performed and the hemorrhage arrested no subsequent action is liable to undo the good work that has been done or hinder the permanent closure of the vessel.

In both ligature and torsion, natural hæmostatics are aided in their work; but in the former, the ulceration set up by the ligature may materially interfere with the perfection of the process; in the latter, there is nothing to prevent the process going on to its completion.

When a true antiseptic ligature has been found, by which a vessel can be secured without the introduction of any permanent cause of irritation, the above comparison will not hold good; but at present it is not in existence, although Mr. Lister's investigations in that direction with catgut ligatures steeped in carbolic acid are encouraging in the extreme.

When an artery is torn across, even a large one, bleeding rarely takes

place. I have seen the femoral and brachial torn asunder and no bleeding follow, the lacerated vessel appearing under these circumstances as if drawn out, the elastic external tunic being stretched into a conical form over the inner coats that have been divided and have retracted. Bleeding is arrested by the drawn-out external tunic and the sheath, the divided and broken up inner coats probably assisting somewhat as in torsion. The knowledge of the above fact, indeed, suggested to Amussat the idea of practicing torsion of an artery. An artery divided, therefore, by laceration or torsion, however large, rarely bleeds.

Contused vessels are occasionally followed by hemorrhage, that is when the injured part has been so damaged as to cause it to slough. Such a result is, however, rare in civil practice; in military, from gunshot wounds, it is more common. The bleeding under such circumstances occurs after the fifth day. A severe contusion may, however, lacerate or break up the inner tunics and thus cause their separation from the external cellular coat and the subsequent closure of the vessel. It is probable that this is the usual mode in which an artery becomes imperious after a contusion. I have known the axillary artery to become permanently closed after a local contusion, and Mr. Moore has recorded a case in which the inner coats of the common iliac artery were partially detached from the outer coat and inverted downwards after a blow upon the part.

It is a question whether adhesive inflammation ever takes place in an artery to cause its occlusion without some laceration of its inner tunics as a result of contusion.

Sometimes a vessel will give way in a part that has been severely contused some days after the injury, causing a secondary subcutaneous hemorrhage—the vessel rupturing with the sensation of something giving way. Cold lotions will, as a rule, suffice to induce absorption. In some cases the fluid blood may be drawn off with a good result.

On Hemorrhage and its Treatment.—When bleeding takes place rapidly from a wound after an injury or operation, it is called *primary*; when it occurs within twenty-four hours, or in rare cases within two days, it is called *recurring* or *intermediary*, and when after the lapse of a longer period *secondary*.

The *primary* is due to the direct injury of the vessel. The *recurring* to the increased force of the circulation during reaction, and the displacement of clots that were sufficient to seal vessels when the circulation was feeble, the overlooking of a vessel during the dressing of a wound, or to some imperfection in the mode of securing it at the time of operation. The *secondary* is caused by the giving way of an artery or vein; by ulceration of the ligature; sloughing of the vessel, alone, or with the tissues around; the accidental separation of a ligature; injury; or the hemorrhagic diathesis.

When the blood escapes from a wound externally, or into a cavity, it is called *hemorrhage*; when beneath the integuments or amongst tissues *extravasation* and *effusion*.

FIG. 47.

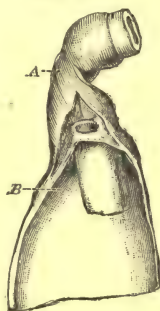


FIG. 48.



"Trans. Med.-Chir. Society," 1868, from paper by the author.

The symptoms of external hemorrhage require no description; the slow flow or the sudden gush of the life's blood may be recognized by all. Those of internal hemorrhage or extravasation require, however, some little attention. They are those of local injury, plus those general symptoms which denote hemorrhage generally.

"In slow and in sudden hemorrhages," wrote John Bell seventy years ago, "the symptoms are very different. In the former the patient is very slowly exhausted; at each return of bleeding the patient faints, and is laid in bed, and the cold applications and the fainting save his life. He rises, after some days, pale, languid, and giddy. The pulse flutters, and is hardly to be felt; the breathing is quick and anxious, accompanied with sighing and great oppression; the heart palpitates on the slightest motion; and the slightest inclination of the head, or rising suddenly from the couch, endangers fainting. The voice is low; the eye is languid, colorless, and of a pearly white; the flesh feels soft and woolly, and the skin is pale, yellow, gelatinous, and, as it were, transparent, like modelled wax. After this stage of weakness the blood loses its color; from this time forward it is a bloody serum only that distils from the vessels; dropsy appears, and the slightest loss of blood proves fatal. But when the patient expires suddenly by an impetuous bleeding from some great artery; when he dies of the bleeding from a femoral aneurism; when he is wounded among the viscera, and some great vessel is pouring out blood, the blood in the general circulation, in place of being forced onwards by the contractions of the arteries, runs backwards towards the wound from all parts of the body. The arteries no longer push on the contents of the veins; the blood ceases to flow towards the heart; the heart ceases to act; and the countenance assumes, as in asphyxia, a livid hue from want of circulation. The face becomes all at once deadly pale, the circle round the eyes is livid, the lips are black, and the extremities are cold. The patient faints, revives, and faints again; with a low and quivering pulse; he is sick; and his voice is lost. There is an anxious and incessant tossing of the arms, with restlessness, which is the most fatal sign of all. He tosses continually from side to side; his head falls down in the bed; he raises his head at times suddenly, gasping, as it were, for breath, with inexpressible anxiety; the tossing of the limbs continues; he draws long convulsive sighs; the pulse flutters and intermits from time to time, and he expires. The countenance is not of a transparent paleness, but of that clayey and leaden color which the painter represents in assassinations and battles; and this tossing of the limbs, which is commonly represented as the sign of a fatal wound, is indeed so infallible a sign of death that I have never known any one recover who had fallen into this condition." (Vol. i, page 143.)

This sketch is so graphic that I have taken it as a whole. Since my student's days when I first read it, it has been fixed in my memory; it is, however, but a page out of the work of a master surgeon which still deserves close study.

A patient may lose a large quantity of blood and yet rally. Children bear the loss of blood badly but rally more quickly. In old age a small hemorrhage is of grave importance, the rallying power being poor.

The Local Treatment of Hemorrhage.—Hemorrhage from any vessel, however large, is readily controlled by the application of well-applied direct pressure *upon the wounded part*, consequently any surgeon on being called to a case of wounded artery, having cleansed the wound and exposed the vessel, should put his thumb or finger on the bleeding orifice and check the flow. No mere covering up of the wound to smother the hemorrhage

will be found of any avail. When moderate bleeding comes from a wound and its source is unknown, whether arterial or venous, the first duty of the surgeon is to *clean the wound and remove clots*. This act alone is often sufficient of itself to arrest bleeding not only for the time but permanently. The parts should at the same time be elevated and left exposed for a few hours.

When the bleeding is venous *the elevation of the limb* has a most beneficial and rapid action. In amputations, after the removal of the tourniquet, the limb should always be elevated for a few seconds to empty the veins. When well applied, *direct pressure* stops the flow of blood, and when such means appear to the surgeon to be sufficient for the treatment of the case, some care should be employed in its application.

The first pad to be applied to the bleeding part should be a small compact one, corresponding to the last joint of the thumb; a larger one should be placed over it and carefully adjusted, a third covering in the whole; these are to be firmly bound down over the bleeding vessel with a bandage or some unyielding strapping, care being observed that the pressure employed is sufficient to control the bleeding, but not enough to arrest wholly the circulation through a limb, and produce gangrene of the parts below.

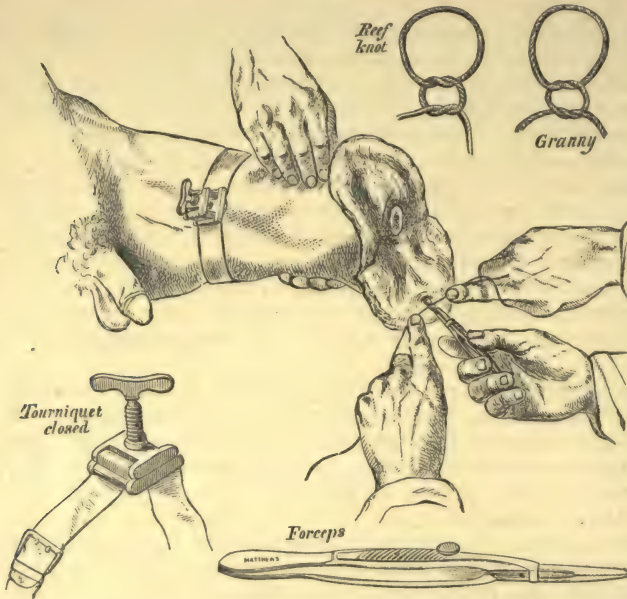
The same remarks apply to the use of the tourniquet; that is, to pressure upon the main artery of a limb above the wound, *by indirect pressure*, as it is called. In operations upon the extremities this is the best mode of preventing or arresting hemorrhage. The tourniquet being accurately applied over the main artery of a limb but not screwed up till the operation is about to be commenced.

For mere temporary purposes the main artery may be compressed by the finger of the surgeon or a skilled assistant; but for a lengthened period this method is untrustworthy, it being impossible for any ordinary man to maintain firm pressure upon a vessel for more than a few minutes consecutively. As a temporary means, however, of arresting bleeding, manual pressure is of immense value; for the lower extremity it should be applied to the femoral artery below Poupart's ligament, for the upper extremity on the inner side of the biceps muscle, the fingers or thumb of the surgeon being employed according to convenience.

The tourniquet is, without doubt, the best instrument to use for the compression of an artery, and J. L. Petit's is probably the best for the extremities. It is to be applied to the limb directly over the vessel to be compressed, the pad being adjusted in the axis of the vessel. The ends of the band are then made to pass round the limb and secured either by a buckle or a knot, the former being the better. The two plates are then to be separated by the rotation of the screw, and a sufficient amount of pressure employed to stop the current of blood but no more. (*Vide Fig. 49.*) Lister, of Edinburgh, has invented an admirable tourniquet for compressing the abdominal aorta, and many others have been made, but the two named are ample for all ordinary purposes of arresting or preventing hemorrhage. When a tourniquet is not at hand, as in the field, a stone or any hard substance may be rolled up in a handkerchief, applied over the vessel, and bound round the limb; the ends of the handkerchief should be attached to a stick or sword, any amount of compression being obtained by simply twisting the stick or sword. As *temporary* means, therefore, of arresting hemorrhage, pressure upon the bleeding spot,—*direct*—or upon the main artery of the part,—*indirect*—digital or instrumental, are the most reliable; the wound in both cases being well exposed and cleansed, and all coagula removed preparatory to the application of such permanent means

as the surgeon has at his command. Of these, the *ligature*, *torsion*, and *acupressure* are the chief. Styptics and the cautery are employed only when the three means mentioned are either inapplicable or have proved unsuccessful.

FIG. 49.



On the Use of the Ligature.—Since Ambrose Paré reintroduced the use of the ligature (1550), it has been the favorite means in the hands of most surgeons for the arrest of hemorrhage; the speedy way in which bleeding from an artery, however large, is checked by its application, and the feeling of relief that a surgeon experiences on knowing that for a time, at least, all fear of bleeding has been removed, has so enamored the majority of men in its favor as to induce them to put aside untried all other means that have been suggested as being unnecessary. It took, however, more than two centuries for the ligature to become established in practice; in fact, its adoption was not general till Jones by his experiments already alluded to had proved to the profession the physiological processes by which hemorrhage is naturally arrested in a bleeding vessel, and that by the ligature these were imitated.

In a former page the way in which the ligature is supposed to act has been explained, and the weak points in the practice have been noticed.

To tie an artery efficiently the vessel should be taken up cleanly and drawn out. A smooth round cord of silk, hemp, or catgut should be applied firmly around its extremity: sufficient force being used to cause rupture of the inner coats of the vessel—this condition although desirable, however, does not appear to be constant with the ligature—and occlusion of the outer coat, a knot called the surgeon's or sailor's reef knot being employed. In forming the knot the loop of the ligature should be pressed down to the artery by the finger or thumb of the surgeon, as indicated in the drawing (Fig. 49), otherwise the extremity of the artery will be liable to be broken off, particularly when diseased.

When the vessel is deeply placed and cannot be isolated, it must be ligatured with some of the adjacent tissues. When it is so imbedded that its free end cannot be taken up with forceps, a tenaculum may be passed beneath the bleeding vessel, and all the tissues taken up by the instrument strangled by the ligature. The ends of the ligature are left hanging out of the wound. Of late years, Mr. De Morgan has been in the habit of cutting off both ends of the ligature, leaving the knot *in situ* and closing the wound, this practice being a revival of an old one of the last century, and Mr. Lister has done the same, having employed catgut ligatures saturated with some antiseptic fluid as carbolic acid. Good results are reported to have followed this practice, but in the instances in which I tried it poor success ensued; the ligature knots (not catgut) in every case having subsequently come out of the wound in the discharge. It is, however, a practice to be thought over and adopted when improved.

When the vessels are diseased and brittle some care is needed in the application of the ligature; the vessel should not be tied too tightly lest too much of the artery be torn, and the ligature separate before natural hæmostatics have closed the vessel. Some surgeons have suggested the use of a flat ligature under these circumstances, but it seems scarcely needed. Not long ago I was called to apply a ligature to the femoral artery of a man over seventy years of age for femoral aneurism, and the vessel was so brittle that I felt the coats give way on the application of the ligature, and the included tissue seemed to be so thin that I expected to find the ligature come away in my hand; in this, however, I was disappointed. The case ultimately did well, no bleeding having taken place.

The mode in which a ligature comes away demands a passing notice, for it is important. In a large number of cases it is by ulceration, but in as many the ligature causes sloughing of the vessel, at the seat of its strangulation, and a ring of artery comes away in the loop of the ligature. In both cases a solution of continuity takes place as a secondary result of the strangulation of the vessel, and unless a firm clot has sealed the artery at both ends or plastic lymph has become organized around the divided coats, the probability that hemorrhage will take place is very great.

Acupressure as a means of arresting hemorrhage has been well received. Its talented deviser, the late Sir James Simpson, brought it before the profession in 1860 with his wonted power, and upon his authority many men have put it into practice. Drs. Keith and Pirrie of Aberdeen, have given it their warmest support; indeed at the present time in Dr. Pirrie's hands it alone is employed as a general way of arresting hemorrhage. The principle of the practice is very simple: it is the occlusion of the artery by the temporary pressure of a pin, without lacerating the vessel or setting up inflammatory and suppurative action as by the ligature. The pin is removed on the second or third day, according to the size of the artery, and the advantages thus claimed for it are very great, but experience has not yet decided in its favor. There are three leading forms of acupressure.

In the *first* the artery is directly compressed between the pin, which crosses its free end, and the muscle beneath (Fig. 50, 1).

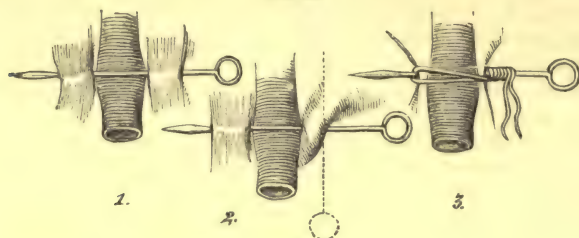
In the *second* the same result takes place, the pin being made to give a half twist through the tissues between its first and second insertions (Fig. 50, 2).

In the *third* the pin is simply passed beneath the vessel and pressure applied to the artery by means of a loop of wire or silk looped over its point and made to cross the vessel, its ends being secured upon the shaft of the pin (Fig. 50, 3).

The *good* point in acupressure is the absence of any foreign body for

more than a few hours or days. Its *weak* point lies in the fact, that its success depends upon the coagulation of the blood in the vessel down to the first branch, one of nature's temporary hæmostatic processes, and not upon the permanent closure of the coats of the vessel; as a consequence it is not so secure as the ligature, or physiologically so sound as the practice of torsion. As a general mode of arresting hemorrhage it seems improbable that it will hold its ground, indeed it is but little practiced at the present

FIG. 50.



time. It is, however, a valuable mode of temporarily arresting hemorrhage in certain cases where the ligature and torsion are inapplicable, as in wounds of the palm of the hand or the sole of the foot; it is particularly valuable also as a means of arresting the flow of blood from a leech-bite or other bleeding point, the passage of a needle through the skin and a figure-of-8 ligature over being of great use.

On Torsion.—In a physiological point of view there is no method at the surgeon's command more perfect for the control of hemorrhage than that of torsion; for unlike acupuncture, which uses one only of nature's hæmostatic processes, or the ligature, which is a foreign body in a wound, and becomes a source of danger by undoing at a later period of the case what has been done at an earlier by nature's own efforts, it utilizes to the utmost all the physiological processes employed by nature to prevent and arrest bleeding, and places them in the most favorable position to take effect. What these changes are was shown at a former page of this chapter.

For the application of torsion a good pair of forceps is required (*vide* Fig. 49), one that will hold the end of the artery firmly, that has no lateral



motion, and with serrations blunt enough to obviate any laceration or cutting of the parts seized by the blades. The vessel should then be drawn out, as in the application of the ligature, and three or more sharp rotations of the forceps made. In large arteries, such as the femoral, the rotation should be repeated till the *sense of resistance has ceased*. The ends should not be twisted off. In small arteries the number of rotations is of no importance, and their ends may be twisted off or not as the surgeon prefers. In Fig. 51 the appearance of a femoral

artery sufficiently twisted is well shown. When the vessels are atheromatous or diseased fewer rotations of the forceps are required, the inner tunics of the vessels being so brittle as to break up at once and incurve. Should the surgeon, therefore, twist more he will break away the external or cel-

lular coat that is of essential importance in maintaining the lacerated inner coats in position, and in allowing blood to coagulate between their septa, and lymph to organize. With this caution diseased arteries appear to be as amenable to this treatment as the healthy, and torsion requires no more care under these or any circumstances than the application of a ligature.

The physiological arguments in favor of torsion are very great, and the practical advantages seem to be no less; for after three years' experience of the practice applied to vessels of all sizes, the femoral being the largest, I have had no mishap. Wounds have united more rapidly and kindly. Primary union being the rule, there has been less constitutional disturbance after operation, and consequently less liability to traumatic fever, pyæmia, and other complications, such as we are all too familiar with in the practice of surgery. I have had stumps heal in a week, and patients up in two weeks, without one single drawback; rapid and uninterrupted convalescence following the operation. In other cases equally good success can be recorded.

Mr. Webber has invented an ingenious pair of forceps for dividing the inner coats of an artery in an irregular way, and thus arresting hemorrhage. They are made by Maw. The principle upon which they act approaches that of torsion, and Dr. Fleet Spiers, of New York, has had an artery-constrictor made, which appears to have the power of dividing the inner coats and allowing them to incurve, as in torsion. I have tried it, and think it may be useful for obstructing arteries in continuity, as for aneurism. ("Med. Mirror," New York, April, 1871.) For divided vessels it has no advantage over torsion.

Astringents or styptics are likewise valuable agents in the arrest of bleeding, when the means previously mentioned are inapplicable; combined with pressure, their value is much increased. The perchloride or persulphate of iron, pounded matico, alum in powder or solution, applied to a bleeding surface on a pad of lint or dossil of cotton-wool, and bound on, are the best; but tannic acid, Ruspini's styptic, or oil of turpentine, are also good. Before applying any of these the bleeding part should be wiped as dry as possible, and all coagula should be removed. In uterine surgery injections of these astringents are much used. In rectal surgery the bowel may be plugged with lint or sponge saturated with a styptic, and in epistaxis the nose may be plugged with the same.

Cold is a powerful styptic, cold air often permanently arresting even copious hemorrhage on laying open a wound. A stream of cold water directed on a bleeding part or ice pounded and placed in bladders or bags and then laid on bleeding wounds are at times of great assistance.

Cauterization, although the common mode of arresting bleeding by the ancients, is now seldom employed; yet it is a valuable agent in cases where neither torsion, ligature, nor acupressure is available. In spongy tissues from which blood is oozing, or even in other cases, the hot iron will often act most beneficially. It may be used as the "actual cautery," through iron buttons or cones brought to a *black heat* by means of fire, or as the gas or galvanic cautery, through platinum or porcelain instruments heated by means of gas or the galvanic battery. In both cases the heat should be enough to cause a dry eschar upon the bleeding part, and care should be exercised subsequently not to remove this too soon; indeed, the eschar or scab should be left for natural processes to throw off. The cautery should in no case be too hot, that is *red hot*, as it destroys the vessels too much; it should be of a *black heat*.

Hemorrhage from the *capillaries*, or small vessels, rarely takes place to

any dangerous extent, unless it occurs in "bleeders," or such as labor under the hemorrhagic diathesis. It has always a tendency to stop by itself through the natural hæmostatic processes such as have been described. Should it, however, be too persistent, the surface of the wound should be exposed and cleansed, the stimulus of the air being often sufficient to excite closure of the vessels. Moderate pressure upon the surface of the wound or a stream of cold water over it are also valuable adjuvants.

Venous hemorrhage, unless from the trunks of large veins, usually quickly ceases from the collapse of the veins. Where any impediment, however, exists to the return of blood from the wounded part it may prove troublesome, but its arrest will probably be secured on the removal of the obstruction. The elevation of the wounded part will tend much towards this end, as will also the application of cold or firm pressure upon the spot.

When large veins are divided and the bleeding is copious, they must be tied or twisted. A small opening into a large trunk may be closed with a fine ligature, leaving the main canal free, for wounds of veins heal rapidly, as after venesection.

Injuries, however, of the large venous trunks are of grave importance, and any wound or injury that induces, directly or indirectly, the complete arrest of the venous circulation through one of these, is probably of greater consequence than a wound of an artery.

A vein is known to be opened when black blood flows from the wound in a steady stream, and from its distal part, when pressure above the wound increases the flow, and the pressure below retards or stops it.

Phlebitis is the chief fear a surgeon entertains from an injury to a vein, and when it occurs it is very fatal. Veins will however, doubtless, bear much more manipulation than our forefathers believed, without any such dangerous result ensuing.

The entrance of air into a wounded vein is likewise a source of great danger; but to this subject attention will be drawn in a future chapter.

THE GENERAL TREATMENT OF HEMORRHAGE is of importance, although subsidiary to the local. When *syncope* takes place as a result of loss of blood, the surgeon should not be too hasty in attempting to overcome it, for it is without doubt one of the most valuable means that nature employs to check bleeding and to assist natural hæmostatics; at the same time great care is needed that the syncope be not a fatal one. Should such an event appear probable, the patient should be kept in the horizontal posture with the head low; cool air should be allowed to blow upon the face, or cold water be sprinkled over it; some diffusible stimulant, such as ammonia, ether, or chloroform, may be inhaled, or brandy given in small quantities. In extreme cases some surgeons advise pressure being made upon the abdominal aorta or large arteries, to confine the blood to the nerve-centres; or even transfusion may be employed. This operation, however, has never been in high favor with surgeons; from accoucheurs it has received good support, Dr. Blundell having given it his energetic advocacy. When tried it should not be put off until too late a period, when the hope of rousing the nervous and circulating systems has become almost forlorn. Under all circumstances plenty of bland liquid nourishment should be given, such as milk, eggs, broth, &c., and stimulants in moderation. When the prospects of a recurring hemorrhage exist all food should be given cold, and only stimulants sufficient to excite the failing heart to action. In the convalescing stage iron and quinine, ammonia and bark, are of the greatest value. Opium is a drug that must not be forgotten, for in the restless stage of bloodlessness its action is most beneficial; it must, however, be given with caution, for with a feeble heart large doses are apt to depress. Half-grain

doses repeated at intervals are probably the safest; larger doses may, however, at times be given. When capillary bleeding takes place to any extent after an operation, a full dose of opium, say a grain, is often most valuable.

When the hemorrhagic diathesis exists, iron in full doses is of great service, the tincture of the acetate or perchloride in half-drachm doses being the best. A few doses of oil of turpentine are likewise of value; twenty-minim doses may be given to an adult; gallic acid in ten-grain doses, acetate of lead in one-grain doses, are also of use—all these drugs acting upon the blood and disposing it to coagulate.

Transfusion.—When Dr. Lower, of Oxford, with Sir E. King, in 1665, first practiced transfusion, blood was drawn from an artery and conducted *directly* by means of a tube into the vein of the patient, the blood being propelled simply by the force of the circulation of the emitter. As time progressed the inexpediency of opening an artery was felt, and the plan of transmitting blood from vein to vein came into use, and in 1785 was warmly advocated by Dr. Harwood, of Cambridge. With this change of practice the mode of operating had to be altered, for the force of the venous circulation was found to be insufficient to propel the blood. The *indirect* or *mediate* mode of operating consequently came into use, the blood of the emitter being received into a vessel and transmitted by a tube or syringe into the vein of the patient. To Blundell is undoubtedly due the credit of having devised an apparatus by which the operation can be efficiently performed. He called it first an “impeller,” and when improved a “gravitater” (“Lancet,” 1829). Since his time Drs. Aveling, Hewitt,¹ and Braxton Hicks² have done much towards rendering the practice more safe and certain. The object of the surgeon in the operation is to transfuse blood from a healthy man into a bloodless one, and his aim is to prevent the coagulation of the healthy blood during the operation, and to guard against the introduction of air into the veins. To do this without a special apparatus, the vein of the patient is to be exposed and longitudinally opened sufficiently to allow the introduction of a fine tube—a pad of lint and bandage being applied to the vein below the opening, to prevent hemorrhage.

The blood to be injected is received into a warm vessel, and taken up into a three or four-ounce glass syringe, *well warmed*, and then injected slowly into the vein. The surgeon takes care to expel all air from the syringe before he introduces the nozzle into the canula by holding it point upwards, and pressing the piston till blood escapes, and not being so dilatory as to allow of the coagulation of the blood. Dr. Hicks has suggested the admixture of a solution of the phosphate of soda (one ounce of the phosphate to a pint of water at blood heat) with the blood, in the proportion of one part of the solution to three of blood, to prevent fibrillation. Should Blundell's, Hewitt's, Hamilton's, or Hicks's apparatus be at hand, it should be preferred. Some ten ounces of blood may be transfused, but four or five are often enough; indeed, the smaller the quantity the better.

The operation has not hitherto been a very successful one.

By way of summary the following conclusions may be drawn up *for the treatment of hemorrhage from wounded vessels*.

All arteries, whether divided or wounded, from which blood flows, are, if possible, to be tied or twisted at the seat of injury; and to do this, when room is required, the wound may be enlarged. *Both ends of a divided artery* are to be dealt with separately, and a wounded artery is to be tied above and below the wound.

¹ “Obstet. Trans.,” 1865.

² “Guy's Rep.,” 1868.

When no bleeding is present, no operation is required as a rule; although in exceptional cases this may be deviated from, as when a renewal of the hemorrhage will endanger life.

When *moderate* arterial hemorrhage exists, and the artery cannot be taken up in the wound without an operation, the graduated compress may be employed with a good chance of success; should it fail, the vessel must be secured.

When arterial hemorrhage endangers life, and the artery cannot be treated at the wound, the trunk of the vessel is to be secured above the wound.

When *recurring* hemorrhage is severe, the wound is to be reopened or enlarged, all clots are to be turned out, and the vessel tied or twisted; when moderate, it is to be treated by elevating the part, by pressure over the main trunk of the vessel, or the wound, and by the application of cold, as the ice-bag.

At times all bleeding ceases on the mere exposure of the open wound; at others there is a general oozing. Under these circumstances, if exposure of the wound to the air, or to a stream of cold water, fails to check it, well-applied pressure over the wound will often suffice. In exceptional cases styptics may be required.

Secondary Hemorrhages are to be dealt with in the wound as primary; that is, when bleeding is profuse, the artery is to be re-ligatured or twisted at the bleeding point; when not severe, it will probably be restrained by pressure and the elevation of the part; for in a general way, when secondary hemorrhage takes place after the application of a ligature to a wounded artery, the bleeding comes from the lower end of the vessel. Guthrie has fairly shown that repair is less perfect in the lower end of a divided vessel than in the upper; that there is less contraction and retraction of the vessel, less perfect coagulation of blood and effusion of plastic lymph.

Hemorrhage from wounds of veins can usually be readily arrested by elevation of the limb and moderate pressure upon the part.

Veins may, however, be ligatured or twisted with impunity, should the treatment suggested fail or be inapplicable.

CHAPTER XXIV.

DISEASES OF THE ARTERIES.

ARTERITIS, ATHEROMA, ANEURISM, EMBOLISM, AND NÆVUS.

Arteritis and Atheromatous Disease of the Arteries may be considered together, for there is no question as to there being a close relationship between the two affections. Virchow and Billroth abroad, Wilks and Moxon in this country, have fairly proved that atheroma of an artery is due to a subinflammatory process. That this is not the ordinary accepted opinion is quite true, for in all modern text-books an opposite view is invariably given. The influence of Gulliver's investigations ("Med.-Chir. Trans.," vol. xxvi) has led all his followers to assert atheroma to be a fatty and calcareous degeneration of the inner, and consecutively of the middle, arterial coats, with subsequent thickening of the outer cellular one.

Acute Arteritis, as some authors have described it, must be very rare

indeed, for many recent pathologists have never met with an instance, and it is more than probable that the claret-color staining of the inner coat of an artery has been mistaken for inflammatory injection, and a fibrinous plug for inflammatory exudation. It may, however, occur as a local ulcerative arteritis, especially near the heart, in rheumatic subjects. In a drawing in the Hospital Museum (42nd) a perforating ulcer in the carotid of this kind is illustrated, in which the opening was plugged, and hemorrhage was consequently prevented by a coagulum.

Chronic Arteritis is a fairly recognized affection, more particularly as a local one, where it is generally due to some injury, or to the extension of some inflammatory action from a wound or ulcer. In these cases all the coats of the vessel are infiltrated with inflammatory products, purulent or otherwise, and the vessel filled with a more or less purulent coagulum. This is well seen in the umbilical vessels of the funis after the application of a ligature.

As a general affection chronic arteritis is less common. Wilks ("Guy's Rep.," 1869) and Savory ("Med.-Chir. Trans.," 1856) have published examples in which the principal arteries of the body were thickened and obstructed, the vessels being filled with old clot that was "so closely adherent that the wall of the vessel would split rather than part from the clot. At both the ending and commencing parts the clot was white and like fibrous tissue, and could not be distinguished from the coats, which here were swollen and atheromatous. The adherence, indeed, appeared to be here in the clot also as well as in the arterial coat."—Wilks.

Such cases as the last are, however, rare compared with those of local chronic arteritis, as met with in the arch of the aorta at its bifurcation and other parts. It is indicated by thickening of the vessel and loss of its elasticity, by the external coat changing into a tough fibrous tissue, and the affected part, instead of feeling thin and pliable, becoming hard and leathery. "Now such changes as these are commonly present along with the atheromatous pulp in the deep inner coat, and these are the part of the changes that go by the term atheroma as commonly accepted. Changes of a kind that cannot be regarded as other than inflammatory are present in nearly all bad examples of atheroma; the extent of the inflammatory changes generally surpasses that of the atheromatous, and these inflammatory changes occur often without any atheroma, and especially in younger subjects, about or under middle age. The more inflammatory changes tend more to produce aneurisms than do the atheromatous patches. When atheroma is thoroughly established, so that a pulpy mass is formed in the coats at any spot, this is generally thick and hard and unyielding, and does not give way to pressure so as to form an aneurism. The disease that leads to aneurism is the same disease as leads to atheroma, and I think it is a correct way of describing these relations to say that they are alternative results of this disease of the coats. I mean so that if the subinflammation is severer, then the coats are softened and yield early, before the thickening and stiffening chronic process that leads to the atheroma patch has time to occur. On the other hand, if the subinflammation is lower and slower, then there is not such softening at any time in its course as to lead to aneurismal yielding; but the result is a slow thickening, which reaches a considerable and a sufficient degree before any fatty degeneration occurs within it, and then always the thickening goes further than the granular change, so that the wall of the artery is rather stronger there than weaker; and if the subinflammation be yet slower and slower the fatty or granular change in the coat goes on to an accumulation of lime salts or petrification of the spot, the stone in the wall showing sometimes some rude bone-cells,

so that ossification may be thought really to occur, though the bone is truly a very rough production, if it be bone at all. Now, if instead of being thus slow, so as to give time for the calcareous change of its products, the subinflammation be very acute, then the arterial wall may rupture, and either sudden death or a false aneurism be the result."—Moxon, "Guy's Hosp. Rep., 1870-71."

"I might," adds Moxon, "give practically any number of cases and drawings, showing the active cell formation in cases of atheroma. This cell formation found in the deep layer of the inner coat especially, and causing the production of little nests of cells, in which fat and lime soon accumulate. In severer cases the middle and outer coats, and the deep layer of the inner coat are seen to be charged with lymph-cells in enormous numbers, crowded together, and separating the proper elastic and the muscular fibres into little patches and shreds, while both elastic and muscular fibres fall into a state of fatty degeneration."

In the figures below these changes are to be seen; they are taken from drawings kindly made for me by Dr. Moxon. His description is appended.

Dr. Moxon believes, and I think rightly, that mechanical strain is the main cause of atheroma of the arteries. It is mostly found in arteries at

FIG. 52.

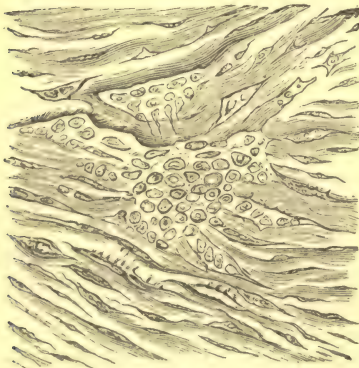


FIG. 53.

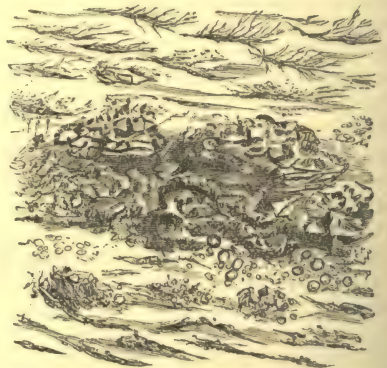


FIG. 52 shows the incipient inflammatory stage of the change in an artery which leads to atheroma.

FIG. 53 shows the final degenerative stage of the same change in the artery which constitutes atheroma.

FIG. 52 is a small portion of a fine section of an artery from the neighborhood of an aneurism; the artery was here soft and swollen, and had a more pellucid and bluish appearance than natural. A small and early patch of the disease is represented. The cells of the artery wall are found enlarged, their nuclei multiplied, and at the centre of the patch they burst towards each other to make a cluster of cells derived from the multiplied nuclei.

FIG. 53 is taken from the same artery at another spot, when the coat had the well-known yellow appearance of atheroma. Here the patch of multiplied cells has degenerated to a heap of oily and earthy matter with some plates of cholesterin. The individual cells around are seen to be degenerated in the same way. Some of those at the upper part of the figure are, on the other hand, developing into elastic fibrils. This is a frequent accompaniment of the atheromatous process, and its effect is to ultimately strengthen the arterial wall at the diseased spot.

It is in the stage seen at FIG. 52 that aneurism usually occurs.

points where the strain upon the coats is greatest, and in men who follow laborious occupations. Gulliver originally described it as a disease of the larger arteries, but it is now known to involve even the minutest capillary—arterial or venous.

In its earliest stage it appears as small white elevated deposits on the inner membrane of the artery—this deposit is made up of fat-globules, with plates of cholesterin, and amorphous calcareous matter, which is soluble in hydrochloric acid. In advanced disease calcareous plates are

found in the larger arteries, and the smaller are converted into complete solid tubes. The vessels, moreover, alter in shape; they become tuberos and tortuous—dilatation taking place at the points of bifurcation. When the disease is very extensive or advanced, the inner coats become destroyed and undermined with blood. When this takes place to any extent, what is known as a dissecting aneurism may be produced; in other cases the inner coat is so raised by the clot of blood behind it, that the arterial canal becomes closed, and gangrene of the parts supplied by the occluded vessel may take place. In a preparation in the Guy's Museum (1465) the aorta was thus affected, causing gangrene of the extremities. In other cases the vessel may rupture, and cause death by hemorrhage. In rarer cases the vessel may be completely closed by the calcareous disease; in some the roughened raised patches become the centres of fibrinous adhesions, which may either cause occlusion of the vessel directly by their size, or indirectly by being carried into more distant arteries, as emboli. In both cases gangrene of the parts thus deprived of blood will be produced. *Senile gangrene* is doubtless occasionally caused in this way. It is thus seen that this atheromatous disease of the arteries is often the cause of gangrene of a part by direct occlusion of the vessel as well as by embolic occlusion. As a general rule, however, in those instances in which portions of artery are found to be withered and converted into fibrous cords, evidence is wanting of arteritis being the cause; indeed, recent investigations tend to show that such changes are the natural result of an obstruction of the vessel, and that this obstruction is probably due to a plugging of the canal by a clot, or what is now known as an embolus.

Embolism, or the occlusion of a vessel, large or small, by a plug of fibrin or calcareous matter, carried by the blood from some distant part, and generally from the heart, is a somewhat common affection. The physician meets with it in cases of paralysis more or less complete, from the plugging of a cerebral vessel, associated with valvular heart disease, so called acute rheumatism, or atheromatous arterial disease. The pathologist sees it in the fibrinous clots found frequently in the liver, spleen, kidneys, or other organs, for any may be involved. The surgeon meets with it in certain forms of amaurosis and local gangrene; any artery may be occluded, even the abdominal aorta.

All these cases are examples of embolism involving the arterial system; but it is to be remembered that when the embolus is carried from the right side of the heart, the pulmonary artery in some of its branches may be closed—giving rise to lobular pneumonia, as seen in pyæmia or gangrene of the lung. In some cases of sudden death, in puerperal women, Sir J. Simpson has shown this to be the cause. After fevers and thrombosis of veins it is also met with; it may also occur after an operation on veins.

Dr. Wilks has also fairly shown ("Guy's Hosp. Rep.," 1870) that, as in phlebitis, morbid matters may be taken up by a vein and carried into the circulation, through the right side of the heart, giving rise to *venous pyæmia*; so disintegrated fibrin of the blood may be carried into the arterial system from the left side of the heart, and give rise to *arterial pyæmia*. Febrile symptoms with joint pains and rigors, associated with aortic or mitral bruit, ought to excite suspicion of this latter affection; and when the liver or spleen is found enlarged, the suspicion should be confirmed. He points out, also, how this occurs after scarlatina as a secondary fever of the nature of pyæmia in which joint pains occur, and not infrequently an endocarditis; and in confirmation of these views I may mention that it has fallen to my lot to amputate a leg for two female patients, aged fifteen and twenty years, for gangrene, the result of occluded femoral arteries after

scarlet fever, and in neither of these cases had any artery to be secured; in both a good result rapidly ensued.

The symptoms of embolic occlusion of an artery are sudden and severe pain in the part from which the circulation is cut off, with numbness and tenderness in the course of the vessel; the pain will at times extend down the whole course of the artery, at others it will be local. Symptoms of a deficient circulation in the part soon appear, such as coldness, and pallor of the skin, and these may go on to complete gangrene. All cases of embolic occlusion of an artery, do not however end in death of the part, for in patients of good power the collateral circulation may become subsequently established and a recovery take place. It is in patients of feeble power that gangrene is generally seen; indeed, it is in such that embolic arterial occlusion is mostly found.

These points were well illustrated by the following case: A woman, æt. 47, who had never had any illness, was seized in June, 1868, with a mild attack of hemiplegia on the left side, from which she perfectly recovered in three weeks. She remained well, and returned to her ordinary duties, those of a laundress, till September 27th, 1868, when, whilst kneeling, she suddenly felt a severe pain in the *right* leg, extending down the calf. This was rapidly followed by numbness and coldness of the leg, and discoloration. She was admitted into Guy's under my care, three days subsequently, with gangrene of the foot and lower two-thirds of the leg. The pulsation in the femoral artery was normal, but no vessel could be felt below the thigh. I amputated the limb at the knee-joint on October 13th, twisting the popliteal and other arteries. Some sloughing of the stump followed, but good success appeared probable, when acute bronchitis set in, followed by delirium and death. Dr. Fagge kindly examined this patient's heart before the operation, and reported, "There is scarcely any evidence of cardiac disease, but I think that I discover a short presystolic bruit. If this is so, the mitral orifice is probably contracted, and a clot formed on the valve, or in one of the heart's cavities, may have been carried into the artery of the lower limb." After death the mitral was found the size of a button-hole. Around its edge were recent vegetations; one of them had doubtless been carried into the circulation and caused the gangrene, as another had previously caused the paralysis three months before. Many cases of senile gangrene are doubtless embolic, from the washing away of some calcareous fragment in an atheromatous vessel.

In some cases of occlusion of an artery by an embolus, as after the application of a ligature, hyperæsthesia and increased temperature of the part below the seat of obstruction may be met with. These symptoms are clearly due to the influence of the nervous system and the congestion of the smaller collateral vessels.

TREATMENT.—The objects surgeons should have in view in the treatment of an occluded vessel from an embolus, are to favor the venous circulation through the limb by its elevation, and to establish the arterial collateral circulation by maintaining the warmth of the limb by means of cotton-wool carefully wrapped round it over oiled lint. Pain is to be relieved by sedatives, such as chloral or opium given by the mouth, or morphia injected subcutaneously, and the powers of the patient are to be maintained by nutritious diet, by stimulants carefully administered, and by tonics.

When gangrene has taken place, the parts may be covered with some antiseptic material, as carbolic acid, in a watery or oily solution, one part to thirty, or powdered charcoal, chloralum, or MacDougal's disinfecting

powder; and, if the odor is not very offensive, simple oakum surrounding the part may be enough.

When the line of demarcation has formed, and the gangrenous part can be removed by amputation, such an operation may be performed, but the surgeon should always be cautious in interfering in these cases. In the two instances of gangrene from embolic occlusion of the femoral artery already mentioned, a good result followed the operation. At the same time operative interference must not be postponed too long.

CHAPTER XXV.

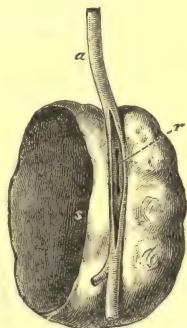
ANEURISM—ARTERIO-VEINOS AND CIRCOID ANEURISM—NÆVUS.

AN aneurism is a *sacculated tumor*, communicating with the canal of an artery, and formed from its walls. When all the coats are involved in the sacculated dilatation it has been the fashion to describe it as being *true*; when the two inner coats have given way, and the external or cellular alone remains, *false*; but I agree with Holmes, that it is impossible clinically to perceive any difference between true and false aneurisms at the time at which they generally come under observation. The true become false as they grow, and the false are far the more common; and I hold with Moxon that pathologically "when an aneurism has reached any size, and often before it has well started, the several coats of the vessel have lost by inflammation their distinctive character, and that the sooner the division of aneurisms into varieties by the supposed behavior of the several coats becomes purely a matter of history the better."

When the distension of the vessel involves its whole calibre, a *fusiform or tubular aneurism*, or aneurismal dilatation is said to exist, whether the enlargement be or be not due to an inflammatory disease of the arterial coats. What is described as a *diffused, spurious, or consecutive aneurism* is a ruptured aneurism or a ruptured artery, where the sac of the aneurism is not formed by any of the arterial coats, but by the muscles and condensed cellular tissue of the part into which the extravasated blood has been effused. These terms should not be applied to cases of *diffused extravasation* of blood in a part from a ruptured artery or aneurism.

A *dissecting aneurism* is that in which the inner coat is separated from the middle, or where blood is extravasated into the thickness of the middle coat itself, or between the middle and external coats, the blood re-entering the cavity of the artery at some distant spot. The aorta is the part usually affected, and even its whole length may be involved. An excellent example of this affection has been recorded by Dr. Fagge ("Med.-Chir. Trans.," vol. lii). These cases, however, rarely come into the hands of the surgeon. To show what an aneurism may do, the following figure (Fig. 55) has been given. It was taken from a drawing in the Guy's Hospital Museum. The

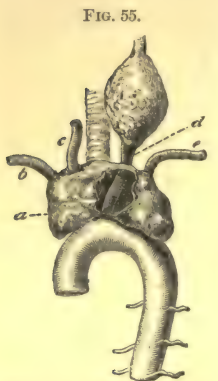
FIG. 54.



Sacculated traumatic aneurism. Drawing 44¹⁸, Guy's Hosp. Mus. Mr. Poland's case.

aneurism of the innominata has involved the left carotid and root of the subclavian, a second aneurism of the left carotid existing above.

Pathology of Aneurism.—A low form of inflammation of the arterial walls is without doubt the most prolific, and overaction of the heart and circulation, the exciting cause of aneurism: direct injury to an artery is an occasional cause (traumatic), although more frequently the injury sets up the disease in the artery that leads to it. Whenever the coats of an artery are weakened by accident, disease—suppurative or otherwise—or the loss of their natural support, they become prone to dilate under any sudden or prolonged increase in the force of the circulation, violent exertion, or sudden emotion of the mind. Dr. Rendle of the Queen's Prison, Brixton, has recorded two cases in which abdominal aneurism could be traced to the shock caused by a sentence of transportation. Thus aneurisms are most common in the aorta, where chronic inflammatory changes are so prone to appear, and the heart's action is the more directly felt; at the bifurcation of an artery, where the force of the circulation is always more powerful; or at the flexure of joints, where muscular action is the most prone to tell by overstretching or bending.



Drawing 42nd, Guy's Hosp.
Mus.

That it is a disease of the arterial system and not always traumatic is proved by the fact that a man may have an aneurism form when in bed, and that the whole arterial system may be involved in the disease. Broca has mentioned a case of Pelletan's, in which sixty-three aneurisms were found in one body. Aneurism is also a disease of middle age, half the cases, according to Lisfranc, occurring between the ages of thirty and forty-five, rare cases being on record in which it was found in children. Syme has reported a case in a child aged nine.

An aneurism when once formed has a natural tendency to increase, the sacculated more so than the fusiform, and the sacculated aneurism communicating by a small opening with the cavity of an artery, as a rule, runs its course more rapidly than another in which the opening is free. The force of the circulation is more concentrated upon one point of the aneurismal sac when directed through a small orifice than through a large one, and more when directed through an orifice than when diffused over an expanded artery. Hence sacculated aneurisms attain a much larger size than the fusiform, and are far more liable to rupture. On the other hand, the sacculated aneurism is more capable of a natural cure than the fusiform, the cavity of the former probably undergoing a partial closure, and possibly a complete closure by the coagulation of the blood; whilst it is a rare thing indeed for a fusiform aneurism to undergo any such natural recovery, that is, when produced by a simple dilatation of all the coats. When the coats are diseased the fusiform is as prone to increase as the sacculated, and as capable of a spontaneous cure. In all cases, therefore, of sacculated aneurism, and in some of fusiform a *spontaneous cure* may take place, and this is realized by the filling of the sac with coagulated blood and its subsequent consolidation. When this process is slow the fibrin of the blood is deposited in layers or laminæ (Fig. 56), the external layer in contact with the walls of the sac becomes united with it, and so strengthens it as to prevent its dilatation. It becomes dense by contraction and decolorized. Subsequent layers form in the same way as the process of recovery goes on, until the whole sac becomes filled and finally obliterated. A section of an

aneurismal sac thus cured resembles much that of an onion, the outer laminae of fibrin being thin, fibrous, firm, and bloodless, each successive layer towards the centre approaching more the color and consistency of newly coagulated blood. Broca has described the laminated coagulum lining the sac as "active clot," and the soft coagulum in the centre, "passive clot," from the idea that this latter is a mere post-mortem deposit and not a vital one. This view can hardly be correct, as there can be little doubt that in all cases of aneurism that are rapidly cured by pressure, digital or otherwise, the consolidation of the sac must be due to the simple coagulation of the blood in the sac, and its subsequent induration and contraction; for a few hours are clearly too short a time for the laminated coagulum to form in any other way. In the following beautiful drawing (Fig. 57) by Dr. Moxon, taken from a specimen of popliteal aneurism, which was cured two years before by digital compression after four and a half hours (*vide* "Guy's Hosp. Rep.," 1869), the whole pathology of aneurism is shown.

Colles, of Dublin, with some older pathologists, used to think that the fibrin that lines the sac was the product of an exudation from the lining

FIG. 56.



Laminated coagulum removed from axillary aneurism twelve years after Mr. Key had ligatured the subclavian artery. Prep. Guy's Hosp. Mus., 1499st.

FIG. 57.

Section through an aneurism of the popliteal artery, cured nearly two years before by digital pressure. The aneurism is not dissected out, but left imbedded in the popliteal fat, *e, e*.

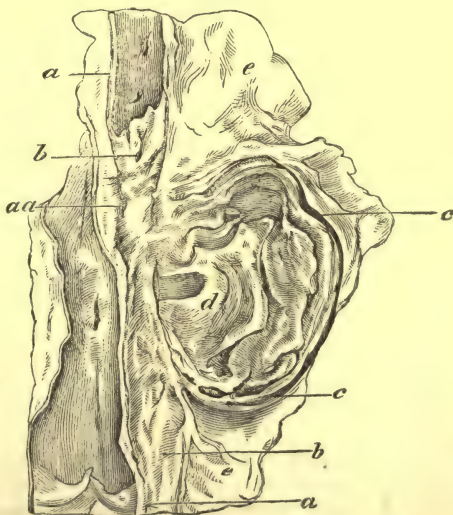
a. The section edge of the arterial coats were healthy.

a, a. The coats in the diseased and occluded part of the artery. Their substance is dispersed and blended with the new fibrous tissue *b, b*, which fills the vessel, yet not so much diffused but that they can still be traced to the mouth of the aneurism (opposite the upper *c*).

c, c. The aneurismal sac, composed of laminated clot and compressed tissue welded together indefinitely.

d. Scarcely laminated clot, filling the hollow of the sac.

The vein with two valves in its lower part, is seen close behind the artery.



membrane of the sac, and that successive exudation of this material formed the laminae. This view, however, has now nearly exploded. Le Fort also accounts for the cure of the fusiform aneurism by inflammation of the inner lining of the sac, looking upon the fusiform as a simple dilatation, which it is not in all cases. Most pathologists, however, now admit, that where the inner tunic of an artery exists in a healthy state in an aneurism, the coagulation of the blood within the sac does not take place, and that consequently a spontaneous cure is impossible; that in the sacculated or fusiform aneurism successive deposits of fibrinous laminae only take place, when the internal

membrane is absent, from the contact of the blood with the walls of the sac. A unique case of Dr. Adams, of Dublin, as recorded by Poland, of fusiform aneurism of the subelavian, tends to support this view ("Med. Chir. Trans.," vol. lii, 1869).

An aneurism may likewise be cured by the distal occlusion or plugging of the artery beyond the sac with a clot that has been dislodged by the force of the circulation, accident, or design. The vessel may be at first only partially closed by the clot, but fresh fibrin will soon be deposited upon the "embolic plug" and complete obstruction be produced. This natural mode of cure is utilized in the distal operation for the cure of aneurism as in the cure by manipulation. Recovery may also be caused by the sloughing of the tumor (suggesting the treatment by caustics); it is likewise on record that the artery with which the aneurism is connected may be obstructed either above or below the sac by the pressure of the aneurism itself; either from its being bound down by a strong fascia, or from the pressure caused by effused blood following its rupture. In the treatment by flexion this natural mode of cure is made use of. As an aneurism increases, and encroaches on the neighboring parts, tissues are separated and even absorbed; bone may even be gradually worn away by the steady pressure of the pulsating tumor, so that in thoracic aneurism the sternum may be perforated, or the bodies of the vertebræ eaten away and the spinal canal opened ("Prep. 1489th, Guy's Hosp. Mus."). During this increase also the tissues surrounding the sac may inflame, rarely, however, suppurating, and by becoming condensed give the aneurism some support and tend to retard its growth. In rare cases, however, this inflammatory action may involve the sac itself and cause sloughing; when the aneurism increases unchecked it will eventually give way. A thoracic or abdominal aneurism may burst into a mucous tract such as the trachea; pharynx, œsophagus or intestine, and when it does Dr. Gairdner ("Med. Chir. Trans.," vol. xlii) has shown that it proves fatal by a recurrent hemorrhage through a *small* orifice; when it bursts into a serous cavity, such as the pleura, pericardium or peritoneum, it destroys by a sudden hemorrhage through a *large* aperture. Cases are also on record where it discharged itself into a vein or the pulmonary artery. External or surgical aneurisms burst by the formation and giving way of a slough. Aneurism of the extremities in surgical aneurism may give way into a joint or cellular tissue; in rare instances an aneurism may burst externally.

The surgeon has, however, more to do with external than internal aneurisms, and although the pathology of both forms is alike, the treatment differs. It is, therefore, to surgical aneurisms that the following remarks will particularly apply, and first of all as to their symptoms and diagnosis.

Symptoms.—The early symptoms of an aneurism are very uncertain, and it often happens that the first to which the patient's attention is directed is some *swelling*, it may be that *local throbbing* preceded the discovery of the local disease—some weakness or stiffness of an extremity—or some *nerve pain*, but such symptoms are not constant. When, however, the surgeon is consulted for pain that shoots down the course of a nerve running in contact with a large artery, he should allow the thought of aneurismal pressure to pass through his mind, and when this is associated with the presence of a tumor connected with the vessel the suspicion of its being aneurismal should be excited. Should this tumor be *soft* and *pulsating*, should it become tense on the application of pressure to the trunk of the artery on the distal side, and flaccid, non-pulsatile, and vanishing on pressure by the arrest of the circulation on the cardiac side, and should pres-

sure on the tumor modify the pulse in the vessel below, the chances of its being aneurismal are almost positive. Should it expand again readily on the removal of the pressure; should this expansion be accompanied with a peculiar thrill on the readmission of blood in to the sac, and with a bellows-murmur or aneurismal bruit synchronous with the pulse on the application of the ear, the diagnosis is complete.

The pulse of the extremity below the swelling is generally affected, becoming weaker and slower than its fellow, and as the disease progresses it may cease altogether. The blood will then flow in a "venous stream," or ceasing to flow either from the obstruction of the arterial trunk by the pressure of the aneurism, or the embolic occlusion of the vessel below from a dislodged coagulum, fulness of the veins with œdema of the parts supplied by the artery will soon appear, and at times pain from nerve stretching is excruciating. Should the aneurism be cervical and the circulation through the brain be interfered with, giddiness and loss of consciousness may be present, and where any pressure is made upon the recurrent laryngeal nerve the peculiar and characteristic hoarseness will be produced. This hoarseness is sometimes associated with loss of voice and laryngeal spasm simulating laryngeal disease; in a case of aortic aneurism, in a woman æt. 22, below the opening of the left subclavian, pressing upon the left bronchus and trachea, this symptom was so severe as to call for tracheotomy. When the cervical sympathetic ganglia are pressed upon, the pupil of the affected side may be permanently contracted, and nerve pains will be present according to the amount of pressure that is produced.

When an aneurism has partially consolidated, or has so enlarged, or become diffused as to press upon the soft parts and lose pulsation, some difficulty may be felt in forming a diagnosis, and the surgeon will then depend as much upon the history of the case, as upon the existing symptoms. When external signs of inflammation or suppuration are present the difficulty will be enhanced, for it must be recorded that aneurisms under these circumstances have been opened for abscesses. I well remember a popliteal aneurism having been so maltreated with a fatal result. Such mistakes of diagnosis ought not, however, to occur; they are due to carelessness. The diagnosis of an aneurism may generally be made out by attending to the history of the case and present symptoms. An abscess in contact with an artery may receive pulsation from it, as may any cyst or even solid tumor, but in all these cases the pulsation will cease on the application of pressure to the artery above the tumor, without any change whatever taking place in the tumor itself. I have seen a case of lumbar abscess which pulsated freely from aortic contact. It is rare, also, for such tumors to cause a bruit. Rare cases are on record in which an artery in contact with an abscess or suppurating hydatid cyst was opened by ulceration, giving rise to the idea of an aneurism. Pulsatile tumors of bone may also be mistaken for aneurism; but the fact that they are in bone, and more or less ossific, that the bone is expanded, although perhaps irregularly, and that a bruit rarely exists, ought to prevent error. Yet it must be recorded, that men of the greatest skill and experience have mistaken these cases as they have those of the former group.

TREATMENT.—There is probably no disease that the surgeon has to treat which requires to be dealt with on scientific principles more than aneurism, for all treatment to be effective must be based upon the physiological processes of a natural cure, and the surgeon will be successful in proportion as he is able to use these processes and turn them to account. Thus it has been explained, that a spontaneous cure of an aneurism is commonly caused by the coagulation of the blood in the sac; as a consequence, it

ought to be the surgeon's aim to encourage this in every way, and this end is to be looked for by general as well as local means. To induce coagulation of blood in the sac by natural processes, it is necessary to have a feeble circulation through it; for this purpose, *rest is an essential point of practice*, and it ought to be maintained in every case; indeed, there is reason to believe that by it alone aneurisms have been cured. Luke ("Lond. Med. Gaz.," May, 1845), Bellingham, and others, have recorded instances of the kind; *as a preliminary to all other treatment absolute rest is most essential*.

With the same object bleeding has been employed—it was at one time largely practiced on the authority of Valsalva, who powerfully advocated it, and probably to excess. There seems no reason why it should not be adopted when the force of the circulation is too strong and the powers of the patient good; for bleeding under these circumstances is not only rational but scientific; it lowers the force of the circulation, and at the same time has a tendency to render the blood more fibrinous. In internal aneurism it is calculated to be of more use than in external, but practiced with caution it is doubtless of value in both. Medicines do not seem to have much influence in encouraging the coagulating process; the acetate of lead gave some promise of value in the hands of my colleague, Dr. G. O. Rees, but more extended experience has not confirmed the hopes that previously existed. In external aneurisms its employment does not seem justifiable to the sacrifice of local means, but in internal ones it may still be used. *Nutritious but unstimulating* food should be given in all instances to maintain the powers of the patient, but not to increase the force of the circulation. All mental excitement should be positively forbidden.

The local treatment of aneurism is based on similar principles, the surgeon's aim being to diminish the circulation through the sac; *by compression in one of its forms* upon the artery above the aneurism—*indirect*; *by compression of the aneurism itself—direct*; by the *Hunterian operation*, the application of a ligature to the artery on its cardiac side; by imitating the rare natural process of closing the artery on its distal side by the application of a ligature; or the artificial production of an embolic plug by Fergusson's method of *manipulation*; and last of all, the aneurism may be laid open and both ends tied (Symes's operation), after the ancient method of Antyllus.

Compression.—This plan of treatment, to which the term "Dublin Method" may be fairly given, has now found a firm place in surgery; for Hutton, Bellingham, Tufnell, and Carte, although they did not originate the practice have adduced ample evidence of its scientific and practical value. It essentially consists in the more or less complete cutting off of the supply of blood from the aneurismal sac by the application of pressure to the artery on its cardiac side; and the more completely the current of the blood is arrested the more rapid appears to be the cure—modern experience fairly proving the soundness of Dr. W. Murray's observation, that the principle on which the rapid method rests is clearly "the complete stagnation of a mass of blood in the aneurism until it coagulates." For this purpose digital pressure is undoubtedly the best; when this cannot be made available mechanical means must be employed, and the nearer it approaches to digital pressure the more undoubtedly it is to be preferred.

The practice is theoretically sound and practically safe; it is capable by itself of curing the majority of surgical aneurisms—and some internal—and when it fails, in no marked manner militates against the adoption of other means, as the application of a ligature; indeed, if it does not succeed in curing every case in which it is employed it doubtless helps, both

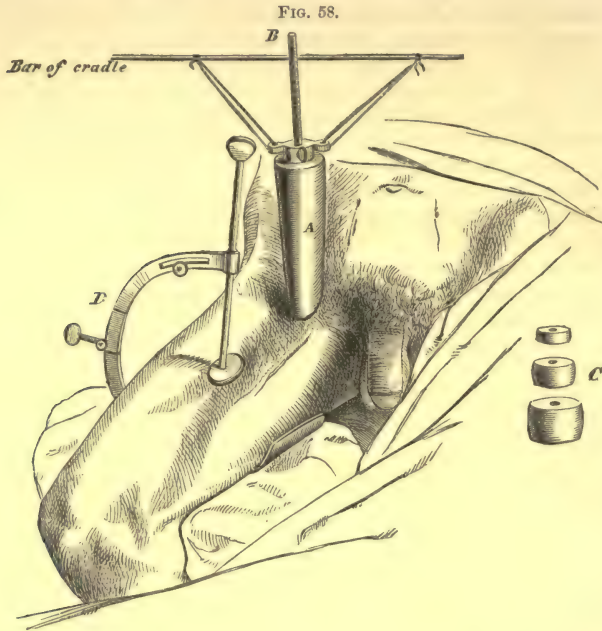
by promoting coagulation of the blood in the sac, and by producing enlargement of the collateral vessels.

Compression should not be attempted where evidence exists of pressure upon the main vein of the limb, as indicated by œdema; or where the aneurism is rapidly increasing, or a rupture of the aneurism appears imminent; for in such the application of a ligature to the arterial trunk should be performed. It should not be persevered with when sloughing of the skin has been induced; and it cannot when from some constitutional irritability, indocility, or stupidity, the patient fails to second the surgeon's aims, for to make the patient understand the objects the surgeon has in view is without doubt a valuable means of guaranteeing their successful accomplishment. I know of one case in which a carotid aneurism was cured by digital compression, and M. Rouge of Lausanne reports another in which a man æt. 68 had a carotid aneurism cured in seventeen days by lateral pressure between the thumb in front of the sterno-mastoid muscle, and the fingers behind ("Dub. Quart." Feb., 1870). Mr. Gay has also apparently cured a subclavian aneurism by the same means ("Lancet," Feb., 1872).

But for digital pressure to be successful it must be well applied; when indifferently carried out it is probably less to be relied upon than instrumental pressure. To keep up a steady pressure upon the trunk of any artery for many minutes consecutively is a difficult task; and few men can do it beyond ten: what is wanted is the steady equal pressure of a finger or thumb applied directly over the vessel which is to be compressed; the pressure being so adjusted as to be sufficient to arrest the flow of blood through the artery, but no more. Neither vein nor nerve need be much pressed upon, as a rule, nor much pain produced. Greater pressure than this is a waste of power on the part of the surgeon, and a needless cause of distress to the patient. To carry out this treatment three good men should be employed for four or five hours consecutively, each in rotation carefully applying pressure for ten minutes at a time. By adopting this practice I have cured an aneurism of the thigh in twenty-four hours, and even less time has sufficed in other cases. In a case I recorded in "Guy's Hosp. Rep." for 1869, a patient æt. 32 cured himself of a popliteal aneurism by pressure in four and a half hours; and in a more recent case a man æt. 40 cured himself in eighteen hours after flexion and prolonged surgical treatment by instrumental pressure had utterly failed. M. Vanzetti in 1855 recorded a case in which digital compression cured a popliteal aneurism in four hours.

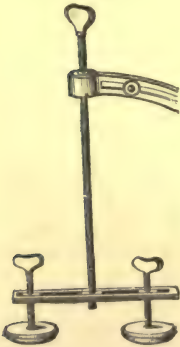
When digital pressure can be employed and is successful it is more rapid than any other, and, as a rule, less painful. It can also be used where instrumental pressure is inapplicable, as to the carotid. In fact it should always be primarily employed in preference to any other form of treatment when admissible. *When digital compression cannot be applied the next best is instrumental pressure*, and for this purpose there is nothing equal to a conical weight of lead (Fig. 58 A) covered with leather and perforated with an iron axle (B) upon which extra pieces of lead (C) can be dropped (Bellingham's Method); the weights being so adapted as just to arrest the circulation through the artery such as the femoral, but no more. This weight can be slung to a cradle placed over the limb, held by an assistant, or left to the intelligent patient. It can be shifted gently from one spot to another when pressure causes pain, and is far less painful than any other instrument. In popliteal aneurism the weight may be adjusted to the upper part of the groin, and it is a good plan to apply a semicircular tourniquet lower down, by which means pressure can be applied alternately. The

instruments of Signorini, Bellingham (Fig. 58 D), Skey, Crampton, or Carte, or any other that allows the pad to press upon the vessel, and not



otherwise interfere with the circulation through the limb, may be used for this purpose. All of these consists of a circle or semicircle of steel, a fixed

FIG. 59.



pad being attached on one side for counter-pressure, and a movable pad, adjusted by a screw, for direct pressure. Indeed, with these instruments carefully adjusted by the aid of a trustworthy assistant who will see that pressure is well applied and maintained, and shifted only when required, most cases of aneurism of an extremity may be treated. In Fig. 59 is depicted an ingenious contrivance made by Weiss, on the principle suggested by Mr. F. Bulley, for the application of pressure to an artery by means of pads, which may be used alternately, and adapted to Bellingham's instrument (D, Fig. 58) either by the rigid screw or elastic pressure of Coles's pad (Fig. 60); and in Fig. 60 a very valuable one as suggested by Mr. George C. Coles—the pressure being elastic—that may be used as hand pressure or adapted to any of the tourniquets. The treatment by compression

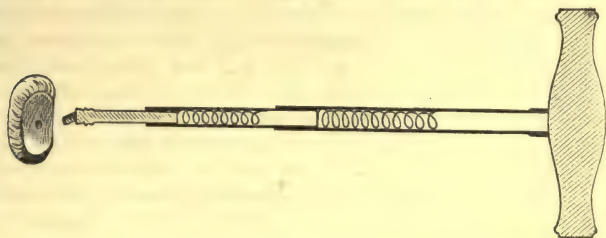
requires intelligent supervision to be successful; without this it is uncertain in its effects, with it it is most successful.

An intelligent friend, Mr. Davies Colley, my present assistant surgeon, who happened to have been my dresser when a case of popliteal aneurism was under treatment by digital compression, tells me that he proved by experiment that he could readily arrest the circulation through the femoral artery for six or eight hours at a time with his finger applied directly over the vessel, and the weight adjusted upon his finger. The weight acting in

lieu of muscular power that would have been required as the compressing force.

To neutralize the effects of the local irritation of the skin by the pressure, free use may be made of French chalk, starch, or violet powder. To allay pain opiates, or hypnotics, or chloral in full doses may be given, and

FIG. 60.



This instrument consists of a trephine handle, to which is attached a straight rod telescopically arranged. The two upper segments of this rod are hollow tubes, each containing a spiral spring; the lower segment is a solid brass rod fitting into the upper, having at its extremity a screw at an obtuse angle. To the end of this a pad, composed of cotton-wool and horsehair, is adjusted.

in some cases even chloroform may be used, and its influence kept up for several hours to allow of complete compression being maintained. Dr. Mapother did this for twelve hours. There seems little doubt that, in a general way, complete obstruction to the circulation is more likely to be followed by a rapid cure than the incomplete, and that next to the complete, which can be maintained till the aneurism has consolidated, the application of the intermittent complete, compressing force, is to be advocated. That is, complete compression may be maintained for a certain time, and then given up, to be returned to as soon as the condition of the patient will permit. The total suppression of the circulation is doubtless the most rapid plan of curing an aneurism; but the partial suppression is likewise successful although slower. But upon all these points I should like the Dublin surgeons to speak. Dr. Rawdon Macnamara has done so in an able paper (*"Brit. Med. Journ.,"* Aug. 19, 1871), from which the following extract has been taken. It epitomizes the whole:

"A case of popliteal aneurism presents itself for treatment. We determine to use compression. We first carefully ascertain the condition of the patient's general health. If anæmic or hyperæmic, we take appropriate measures; and, when we are satisfied upon this point, we apply some one or other of the most improved compressors—those in which the compressing power is modified elasticity. With this we compress the artery in the upper portion of its course, having previously arranged, some three or four inches lower down, the auxiliary instrument by means of which we propose to alternate the pressure. The upper instrument is now made to control the artery, so as but just to arrest the pulsation in the sac. This is the most delicate step in all the procedure, and is regulated by the hand of an intelligent assistant, who at once informs us when the pulsation is arrested; and then and there the further application of pressure is arrested. A roster of intelligent students is now organized, and to them is intrusted the management of the case. Two are appointed to take charge of the patient for one hour, when they are relieved by two others, and so on during the day, whereby we secure unwearied attention during the period that pressure is kept up; and, as in Dublin we visit our hospital at nine o'clock A.M., the treatment generally commences about that hour, and is continued up to

nine o'clock P.M., when all pressure is removed, and the patient is encouraged to take his night's rest undisturbed. Next morning the treatment is resumed, and so on until the cure is perfected. At the commencement of the case, we take the patient into our confidence; explain to him the nature of his case and the method we are about to adopt for his cure, placing clearly before him the alternative, with all its possible dangers, which we should have to adopt in case compression should fail. The value of this procedure is very frequently demonstrated by the intelligent interest exhibited by our patients in the management of their own cases—so intelligent as in protracted cases to supplement, if not altogether to supersede, the supervision of them by our students. In the selection of our compressing force, we adopt, in its widest sense, the maxim 'Nullius addictus jurare in verba magistri.' Should one compressor prove irksome, we try another; if all should fail, we have recourse to digital compression, or to compression by means of weights; but in every instance, convinced of the soundness of this plan of treatment, we leave no stone unturned to secure its success."

An aneurism is known to be cured when it has consolidated and lost all pulsation, and the anastomosing arterial branches around are visibly pulsating. Care must, however, be observed for some days later, and no movement of the limb or manipulation of the sac be allowed; for in cases of rapid cure the clot that has filled the sac must of necessity be soft, and a very little may cause its displacement, and thus interfere with that natural contraction of the fibrin of the blood that is to fill the sac permanently, prevent its dilatation, and cure the disease.

The treatment of aneurism by *direct compression* next claims attention, and in modern times it is known as that by *flexion*: for there can be little doubt that the *modus operandi* of flexion in the cure of aneurism is caused by two conditions: first, by direct compression of the aneurismal tumor itself; and secondly, by indirect compression of the afferent artery through the medium of the tumor, this indirect compression, either wholly or partially, intercepting the supply of blood to the sac. At the same time we know that forced flexion of a limb is capable of arresting the flow of blood through the healthy artery. In England Mr. E. Hart demonstrated its success in the year 1858, although in 1857, Dr. Maunoir, of Geneva, recorded the first successful case in the "*L'Echo Médicale*" (Neuchâtel), and since then many surgeons have successfully applied the practice. To carry it out, the limb must be carefully bandaged from below upwards to the aneurism, say popliteal, and the knee forcibly bent, some turns of the roller maintaining the limb in this position. The thigh should then be flexed upon the pelvis and the patient turned on his side with the limb resting on a pillow. By this plan the arrest of the circulation through the aneurism may generally be effected, and when pain is not severe a good cure may be looked for; but too often the patient is unable to endure the suffering that the position causes. The plan, however, is so simple, and, when endurable, is so successful, that it should always be attempted where it can be applied. To large aneurisms this method is inapplicable, and probably dangerous, as it may induce rupture; and when any inflammation exists or other complication it ought not to be employed.

Pressure may likewise be used with flexion, where the latter is insufficient, many cases being reported in which success followed the conjoint means. In a case recently under care I cured an aneurism below the popliteal space in eighteen hours by alternating the flexion of the leg with digital inguinal pressure.

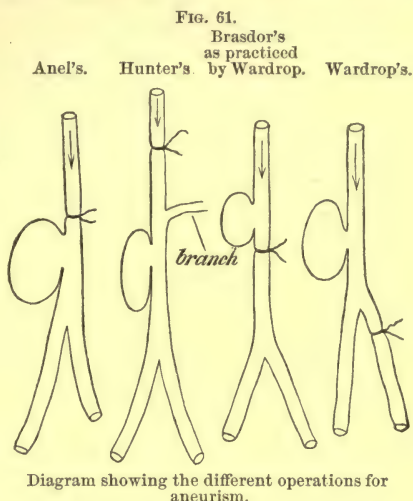
M. Liégeois, in an interesting paper ("*L'Union Méd.*," Aug., 1869) gives

eleven cases in which flexion alone proved successful in popliteal aneurism, and eleven in which it was successful in combination with other measures. In four it succeeded after other means had failed. On the other hand, it failed in twenty-three cases, or nearly half the whole number, and of these, seven are stated to have suffered rupture and one inflammation of the sac.

The Treatment by Ligature should only be entertained when that by compression in one of its forms is inapplicable, or has proved unsuccessful. It should be carried out by the Hunterian method, by the application of a ligature at some distance from the sac, and not by the "*méthode d'Anel*," in which the ligature is applied close to the aneurism. By the Hunterian operation the chief flow of blood through the aneurism is arrested, the collateral circulation is maintained, and the artery is more likely to be healthy where ligatured than at the seat of disease. The operation is likewise, as a rule, less difficult.

A moderately thick round ligature should be employed, either of silk or hemp, or Lister's "antiseptic ligature" of catgut steeped in carbolic acid. In a general way the ligature subsequently ulcerates through, or a portion of the artery sloughs away with it, and in this lies the weakness of the treatment by ligature. This process takes from nine to twenty days, or more, in large vessels. When the ligature fails, and death ensues, it is from gangrene of the parts below the seat of disease, or secondary hemorrhage. The former is the more frequent cause of death, Dr. Norris telling us that out of fifty fatal cases of ligature of the femoral artery twenty-three died of gangrene, and only eight of hemorrhage.

When a ligature is applied to the main artery of a limb, for a time the circulation is more or less cut off; consequently coldness of the part may ensue, and even gangrene; congestion, however, generally gradually takes place in the extremity, from the blood being forced into the collateral vessels, and with this some increase of temperature may be felt, with hyperæsthesia, a point already noticed in embolic arterial obstruction. Brown-Séquard explains the elevation of temperature that is often observed in a part after the application of a ligature to its main artery, by the paralysis of the vaso motor nerves that ramify on or in the coats of the vessel, this paralysis produces a corresponding paralysis of the ramifications of the vessel, and as a consequence the blood finds its way freely through the collateral branches into the part below the seat of the ligature, this blood stasis producing both the congestion of the part as well as the concomitant elevation of temperature.—("Archives de Physiologie," 1851.) The surgeon should consequently, after the application of a ligature, do what he can to maintain the temperature of the limb, and this is best effected by thickly covering it with cotton-wool, at the same time keeping the part raised to encourage the venous circulation. Simple nutritious food should be allowed, but stimulants should be given with great caution, and only enough allowed to help digestion and maintain the force of the heart's action, the habits of



the patient forming the best guide. Should pain be present, opium, morphia, or chloral must be prescribed in doses sufficient to afford relief, either by the mouth or subcutaneously.

When the ligature has separated, the wound healed, and the aneurism consolidated, no forcible or prolonged exercise of the limb must be allowed for some weeks, although gentle exercise will be good. The limb also should be kept warm, for it has happened that the circulation through it has failed to become full, or even sufficient after the operation, and that some permanent weakness and loss of sensation has been left. A patient may, however, live a long life after even a double operation; in 1864 I saw a man, æt. 51, upon whom Mr. B. Cooper had operated twenty-three years before (1841) for popliteal aneurism of the left leg, and of the right in 1843; he was an orange porter, and had subsequently followed his work. When gangrene takes place, it is generally as a direct result of the cutting off of arterial supply from a limb, and the ensuing congestion; as a consequence it occurs within a few days of the operation. It may, however, be produced by the presence of an inflamed or rapidly increasing aneurism, and has then little or nothing to do with the operation. It must be dealt with energetically. Should it be spreading rapidly, and threaten life, amputation of the limb about the line of ligature should be performed without delay. Should it be limited in its nature, and not progressive, the expectant treatment must be employed, the warmth of the limb being carefully looked to, the sloughing or dying parts covered with well-oiled lint, the venous circulation assisted by the elevated position and by gentle friction, and the powers of the patient being stimulated by food and wine, and pain allayed by opiates. The poor success that, as a rule, follows amputation for gangrene coming on under these circumstances, seems to be due too much to a hesitating practice, and the postponement of operative interference till too late a period.

When the sac of the aneurism inflames and suppurates after the application of a ligature, it may be regarded as a local gangrene, the result of the operation; it is a dangerous complication, and no definite rules can be laid down for its treatment. Hemorrhage is occasionally a result of this action, the blood coming from the lower end of the vessel: pyæmia or blood-poisoning is another. In a general way amputation is the best practice when it can be performed. In August, 1871, I applied a ligature to the left carotid artery of a man, æt. 29, for a large aneurism, and death ensued on the thirty-fourth day, from suppuration of the sac, nearly the whole aneurism having sloughed. This process had been preceded by some hemorrhage on the thirteenth day after the operation. The same result may take place after the cure by compression, rapid or slow; indeed, it is an open question whether aneurismal sacs that have been suddenly filled with coagula are not more prone to break up and suppurate than others in which the process has been more gradual. In rare instances the pulsation of an aneurism reappears after the Hunterian operation; a passing feeble pulsation in the sac a day or so after the application of the ligature is by no means a rare occurrence, nor need it excite any alarm in the surgeon's mind; it will to a certainty pass away. It is doubtless due to the passage of a feeble current of blood through the sac by means of a collateral branch. Should the *pulsation be persistent*, or, indeed, not be arrested by the ligature to the main trunk, there will be good evidence of a "vas aberrans" existing by which the blood is brought direct to the aneurism, and which must be ligatured before a cure can be expected. Should its presence be made out by the symptoms just indicated at the time of operation, the vessel must be looked for before the main trunk is tied: indeed, it may

be possible that no necessity will be found to tie the main trunk, for the operation for aneurism is to tie the vessel that supplies it quite independent of any name. To do this much surgical skill is called for, and great care. Should it not be possible to apply a ligature to the supplying vessel, other means may be employed, such as compression, or flexion, but in all probability these have been previously tried and have failed, and under such circumstances a second ligature may have to be put on near the sac; or the original operation for aneurism—that of Antyllus, or more recently of Syme—may be required, that is, the laying open of the sac of the aneurism, and the application of a ligature above and below the aperture into the artery. To do this much boldness and operative skill are needed to prevent a fatal hemorrhage. With this object in a case of axillary aneurism, Mr. Syme made an incision above the clavicle along the border of the sterno-mastoid muscle to enable an assistant to compress the subclavian artery against the first rib, acting upon the same principle as he adopted thirty years before when he made an incision behind the angle of the jaw to enable an assistant to compress the internal maxillary artery before the removal of the upper jaw. In 1861 he laid open a gluteal aneurism, having previously thrust a bistoury into the tumor over the situation of the gluteal artery and introduced a finger so as to prevent the blood from flowing except by occasional gushes. He eventually thrust his hand into the sac, rapidly turned out the clot, and had the bleeding orifice instantly under subjection by the pressure of the hand. Both these cases did well.

Still this practice is only applicable to desperate cases where all other modes of treatment have failed, or are inapplicable. I successfully employed it once, ten years ago, in a case of aneurism of the radial artery; and in October, 1871, in a case of traumatic aneurism of the radial in the middle of the arm in which the vessel was punctured, I divided it completely and twisted both ends, a rapid recovery following.

When a ligature cannot be applied to the cardiac side of an aneurism, and the treatment by compression, &c., has failed or is inapplicable, Brashdor's or the distal operation may be entertained, that is, the application of a ligature to the vessel as it leaves the aneurism. It is not, however, an operation that can be recommended with any confidence, except in carotid aneurism, in which Wardrop performed it in several cases with success. In aneurism of the innominate artery it is also open to the surgeon to ligature the carotid and subclavian arteries consecutively or simultaneously, Mr. Fearn's case and others rendering the operation justifiable. In August, 1871, I performed Wardrop's operation on a man æt. 33 for innominate aneurism. I ligatured the subclavian with a carbolized catgut ligature and closed the wound, sealing it with lint saturated with the compound tincture of benzoin; a good recovery from the operation ensued, and considerable consolidation of the aneurism. The man left the hospital thirty-six days after the operation so well satisfied with the success of the case that it is a question whether he will return to have the carotid ligatured, should it be considered necessary. This operation was originally suggested by Wardrop. (Fig. 61, page 187.)

The treatment by *manipulation* also requires notice, for it has been introduced by no less a man than Sir W. Fergusson. It is based on natural although exceptional processes; the embolic occlusion of the distal end of an artery by a dislodged clot. In two cases Sir W. Fergusson endeavored by manipulating the sac to dislodge the clot, and thus give it a chance of being carried by the circulation into the efferent vessel; and in both the success was sufficient to sanction the repetition of the means in appropriate cases when all other treatment is out of question. In cervical aneurism

the dangers of embolism of the cerebral arteries must be borne in mind; yet at the same time it must be remembered that the Hunterian operation for subclavian aneurism has never been successful, and all other means are nearly out of court. Amputation has, however, been performed under these circumstances with success.

To induce or assist coagulation of the blood in the sac other means have been suggested. *The treatment by galvano-puncture* is one of the most promising in theory, but in practice it has not made its place; it consists in the introduction of the two needles of a battery into the sac, around which clot is to form. Dr. Althaus advises the introduction only of one, "the negative." The practice is one that can only be entertained in exceptional and otherwise hopeless cases.

The treatment by injection is another mode that demands notice, although hitherto it has not been satisfactory. Alcohol, tannin, acetic acid, and the perchloride of iron have all been used as coagulating agents, but the last drug is the one for which the most can be said. That it has a powerful influence in causing the coagulation of the blood is well known; but to produce this in the sac of an aneurism by such means is a dangerous proceeding. The most dangerous result is embolism, and the next is inflammation and suppuration of the sac. A solution of the perchloride, diluted to one-twentieth the strength of the British Pharmacopœia solution, is quite strong enough, and about twenty drops of the solution is all that ought to be thrown into a large sac. The graduated glass syringe with screw piston should be employed, such as that generally used for subcutaneous injections. Care should be taken that the perforated trocar be well introduced into the cavity of the tumor, the escape of arterial blood being the only test, and that the afferent and efferent artery be well compressed. The fluid should then be injected, and by manipulation mixed with the blood. When the sac seems solid the canula should be withdrawn, but the pressure upon the cardiac side of the sac should be maintained for a good hour subsequently, to prevent the consolidating mixture of blood and iron being sent onwards.

With objects similar to the above the late Mr. Moore inserted twenty-six yards of iron wire into an aortic aneurism through a canula, his object was merely to detain the fibrin of the fluid blood; but the result was discouraging in the extreme. ("Med.-Chir. Trans.," vol. xlvii.)

In recent times Langenbeck has been led to inject the parts around the sac of the aneurism with a solution of ergotin, with the view of causing contraction of its walls; and Dr. Dutoit, of Berne, relates in "Langenbeck's Archiv" (Band xii, No. 3), a case in which he successfully adopted the practice. The man was forty years old, and the aneurism supposed to be subclavian. Fifteen injections were made at intervals of two or three days over the tumor, which gradually diminished. To render the cure certain, however, digital compression was subsequently employed.

Traumatic Aneurism.—An artery is wounded by a puncture or incised wound; bleeding takes place, pressure is applied in order to control it, and the wound heals. In the course of time a pulsating swelling is discovered, and a traumatic aneurism is said to exist.

A man in wrestling, or after making some sudden unprepared-for muscular exertion, finds something give way in his leg, or fancies he has sprained his knee; in a shorter or longer period some swelling appears, which steadily increases and is pulsatile. This also is called a traumatic aneurism. In both cases some external injury was clearly followed by the aneurism; in the *former* case the injury undoubtedly, in the *latter* probably, caused the aneurism by acting upon a diseased vessel. And yet, if the

aneurism is encysted either by the expansion of the reparative material with which the wound of the artery had been closed, or by the hernial protrusion of one or more of the coats of the artery through a rupture or wound of another, or by the condensation of the cellular tissue into which the blood has escaped, the case differs in no single practical point from any other aneurism that has been already considered; and what is more, it must be treated on the same principles, although as the artery of a traumatic aneurism is healthier than that of a spontaneous one, it may show a greater proneness to cure.

When, however, an aneurism caused by any injury is not encysted, when either from the first it is diffused or becomes so from the rupture of the sac, a different condition presents itself to the surgeon, and the case then appears more like that of a ruptured artery, complicating a sprain, fracture, or dislocation. Indeed, these cases, however they may have begun, must be looked upon as examples of ruptured artery, and must be treated accordingly; not that as a matter of course the vessel is to be cut down upon and tied at once, for such a practice would be wrong and rash in the extreme, every surgeon being aware that in a large proportion of cases a recovery takes place without any such proceeding. In some where the extravasation is severe and no pulsation exists it is impossible to make out with any clearness the true condition of affairs. A limb either with or without a fracture is greatly distended, and this from effused blood, but whether the blood has been poured out from the rupture of a large artery or vein, or some smaller vessel, there may be no means of knowing, for even the pulsation in the vessels below may be indistinguishable on account of the effusion. Under such circumstances no active proceeding can be carried out. The limb is to be elevated, cold applied, and the case left to nature, and in a large number of instances a good result will take place. I can recall several of such where I looked for bad results, and witnessed good ones. Should the effusion be so severe as to be followed by evidence of arrest of circulation in the limb, the surgeon will be justified in cutting down upon the vessel at the point where the history of the case indicates that it is wounded, and tying both ends after having turned out all clot, &c. In other cases the main artery may be tied, but too often there will be nothing left but amputation. No general rule can, however, be laid down for the treatment of all these cases; each one must be treated on its own merits.

But the student should remember—(1.) That every aneurism, however caused, if encysted, is to be treated upon like principles, and that ruptured traumatic aneurisms are to be regarded as ruptured arteries.

(2.) That the rupture of an artery when bound down by a dense fascia, such as the popliteal, is, as a rule, followed by complete arrest of all circulation in the limb—both arterial and venous—and, as a rule, requires to be treated by amputation, gangrene being otherwise the result.

(3.) That in cases of partial rupture there may be less extravasation, and consequently less severe measures may suffice; such as pressure upon the main trunk above, or, if this fail, the application of a ligature to the wounded vessel.

(4.) That a ruptured artery in parts less fascia-bound than the leg, as the arm, &c., may be treated more as in the case of arterial injuries, and consequently locally, by the application of a ligature to the wounded vessel.

When an artery is obstructed the circulation is carried on by what is called the collateral circulation, the vessels coming off from above the obstructed part communicating with those below. At first the vessels are very numerous, but as time goes on their number diminishes, only those

most conveniently situated for carrying on the circulation becoming rapidly or gradually, permanently enlarged.

To illustrate this beautiful compensatory natural act I have, instead of a diagram, given two drawings (Figs. 62, 63), taken from a preparation in the Guy's Museum, No. 1519¹², which was made by Mr. Cock in the year 1826, from a patient æt. 58, for whom Sir A. Cooper had applied a ligature to the external iliac artery for femoral aneurism, eighteen years and a half previously.

FIG. 62.
Anterior view.

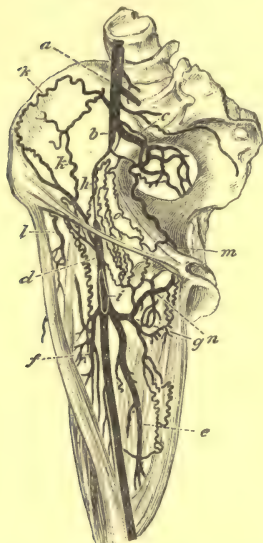


FIG. 63.
Posterior view.

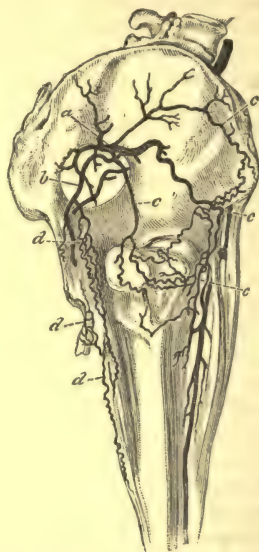


FIG. 62.—*a*. Common iliac artery. *b*. External iliac. *c*. Internal iliac. *d*. Femoral. *e*. Profunda. *f*. External circumflex. *g*. Internal circumflex. *h*. Iliac artery, which had been tied and had become a cord. *i*. Remains of aneurismal sac. *k*. Anastomosing branches of the circumflexa ilii. *l*. Anastomosing branches of the circumflexa externa. *m*. Obturator artery, anastomosing with, *n*, circumflexa interna.

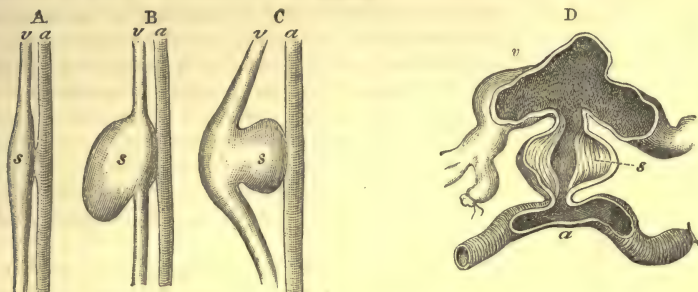
FIG. 63.—*a*. Gluteal artery. *b*. Ischiatic artery. *c*. Anastomosing branches of gluteal with the circumflex. *d*. Anastomosing branches of ischiatic with the perforating branches of profunda.

A full description of the case and preparation is to be found in the first volume of the "Guy's Reports," by Mr. Cock. The drawings need no lengthy description, as they explain themselves.

Arterio-venous Aneurisms.—When an artery and a vein communicate with one another, the arterial blood passing *directly* into the vein without the intervention of a sac, an *aneurismal varix* is said to exist (A, Fig. 64); and when a sac exists into which the arterial blood flows in its passage to the vein, this is what is called a *varicose aneurism* (B, C, and D, Fig. 64). Both these varieties of arterio-venous aneurisms are now rare; but when venesection was a common operation they were far more frequent; for they are usually produced by the perforation or division of an artery through a vein, the opening between the vessels remaining permanent. But both forms may originate spontaneously. Goupil (Paris, 1855) recorded the fact that out of fifty-seven cases of this affection thirty-one were the result of bleeding. Cases are also on record where the aorta and superior or inferior vena cava communicated. Wade ("Dublin Med. Press," 1861) has also recorded a case in which an opening existed between the aorta and

pulmonary artery; indeed, all the large arteries and veins may be similarly affected.

FIG. 64.



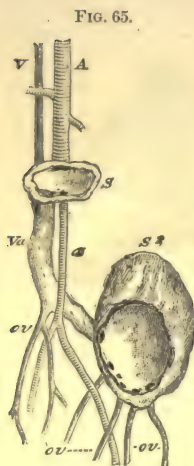
Illustrating the different forms of arterio-venous aneurism. A, the artery and vein directly communicating. B and C, the dilatation being more in the vein. D, varicose aneurism laid open.

In an *aneurismal varix* the vein assumes in some degree the properties of an artery. It becomes enlarged from the arterial impulse, irregularly dilated and tortuous, the dilatation assuming a fusiform or sacculated form; it also becomes thickened and pulsates.

In the *varicose aneurism* the sac may or may not freely communicate with the artery or vein. In some cases it will involve the whole calibre of both vessels; or the vein may be hypertrophied and enlarged, as in the aneurismal varix. In a unique case (Fig. 65) recorded by Mr. Cock ("Med.-Chir. Trans.," 1851), of a traumatic varicose aneurism of the popliteal artery, the sac was small, but it involved the whole calibre of the artery and vein, and the whole of the arterial blood passed through it. The secondary effects of the disease were also shown with singular clearness. It occurred in a man æt. 28, who had received eleven years previously a punctured wound in the popliteal artery, for which two weeks subsequently, on account of secondary hemorrhage, the femoral was ligatured. He convalesced and returned to his work, but two years later he became the subject of "varicose veins." He remained well till three or four months before his admission into Guy's, where he had fever, and on convalescing and trying to walk he discovered his leg was stiff, painful, and swollen. He was admitted with what was supposed to be a large collection of pus beneath the superficial muscles of the calf. The femoral artery below Poupart's ligament, and the anterior and posterior tibial arteries were pulsating freely. The cavity was opened, some ounces of dark grumous, pitchy, non-coagulable blood escaped; the next day a quantity of offensive pus flowed away mixed with coagula. For two weeks everything went on well, when arterial hemorrhage took place; he lost nearly three pints of blood. After due consultation amputation was performed, from which a good recovery ensued.

On dissecting the limb Mr. Poland found an aneurismal sac (Fig. 65, s) the size of a pigeon's egg connected with the popliteal artery; it was of cartilaginous hardness with ossific deposit, and was lined with fibrin and empty. The artery (A) freely entered the sac from above. The vein (V) was obstructed above with coagulated blood, and below was lost in the walls of the sac as a fibrous cord. From the lower part of the sac two vessels issued, the smaller one (a) was the continuation of the popliteal artery *greatly diminished in size*, which divided as usual to the leg. The

larger one (*va*) was the popliteal vein greatly hypertrophied, pouched, and puckered. It was quite pervious, and passed down for about two inches, where it divided into two trunks; one, which accompanied the anterior tibial artery was quite *obliterated*, the other led directly into a *second aneurismal sac* (*s*²) the size of a duck's egg, with the walls of which its coats became identified. It was this sac that had been opened. From the lower part of this *venous sac* emerged three or four large impervious branches that were clearly veins that accompanied the posterior tibial and peroneal arteries. The contents of these veins could be washed out and the valves seen.



Mr. Cock's case.

It must be added that the cutaneous veins that have been described as varicose were greatly hypertrophied, and it must have been clear that the whole of the blood from the leg was returned through them.

In this case it would appear that, as a *direct* result of an injury, a *varicose aneurism* formed, into which the whole of the arterial blood flowed.

That the arterial blood subsequently found a more direct route through the popliteal vein than through the artery, and as a result the vein became hypertrophied and the artery atrophied.

That the force of the arterial blood current upon the thin coats of the vein caused the gradual dilatation of the vein and the subsequent formation of a second aneurism, from the giving way of which bleeding had taken place.

The wasting of the femoral vein above the upper sac is a point of interest, with the hypertrophy of the same vein below the sac, from its taking on the functions of an artery; and not the least interesting point is the great hypertrophy of the cutaneous veins, through which the whole of the venous circulation of the leg must have been carried on.

I have given this case at some length, as it gives better than any general description can do the whole effects, primary as well as secondary, of a varicose aneurism.

In reference to diagnosis it may be mentioned, that at the point of junction of the arterial and venous streams, a peculiar purring bruit is often to be felt and heard, and this bruit often extends down the course of the dilated veins; and where a sac, in which the two blood currents meet, separates the artery and the vein there is likewise a soft bruit. The sac is seldom very large, and is made up of condensed cellular tissue and plastic matter.

TREATMENT.—In neither of these cases is surgical interference generally called for. Should the disease be extensive, and either from pain, mechanical causes, or chances of rupture of the vessels, require treatment, a cure may be attempted by forcible flexion of the forearm on the arm, and supination of the hand, the brachial artery being in this way fairly obstructed; a pad may likewise be placed upon the point of communication between the two canals to make the pressure more perfect. Indirect compression in any other of its forms may also be tried; and on these failing, the case must be treated as one of wounded artery, the vessel cut down upon, and a ligature placed on either side of the opening. The veins need not be interfered with, they will gradually wither as soon as their arterial communication has been cut off.

Cirroid Aneurism, Erectile Tumors, and Aneurism by Anastomosis, have nothing in common with the spontaneous and traumatic aneurisms that have been described, beyond being diseases of the arterial system.

They are clearly caused by an increase of arterial tissue, by a dilatation and elongation of arteries; the term cirroid aneurism being employed when the trunks of the larger vessels are involved, and aneurism by anastomosis when the smaller vessels or capillaries are affected. In the cirroid aneurism one vessel may be diseased or many vessels, the disease showing itself by the artery becoming tortuous, dilated into pouches, and convoluted; when one vessel is alone affected Gosselin called it *arterial varix*. When the disease is upon the scalp, its most common seat, three or four large tortuous arteries may be seen converging to a centre, where a congeries of dilated arteries will be found, probably of new growth. It may, however, affect the arteries of the extremity, Cruveilhier having reported a case in which the external iliac artery was so affected.

Cirroid aneurism is generally found in young people, during the period of growth, and in the majority of cases can be traced to local injury. It can be readily made out by its pulsating nature, and the peculiar tortuous and convoluted appearance of the diseased vessels, not only of the vessels forming the tumor, but of the arteries by which it is supplied.

TREATMENT.—All forms of treatment have been tried in these cases, such as direct pressure, injection, the application of ligatures to the vessels that converge towards the growth, and the ligaturing of the main artery that goes to the part; the tumor has, moreover, been laid open and treated by pressure, with the view of causing obliteration of the growth by the inflammatory exudation that follows this treatment; Gräff, Bell, Arnott, and Lawrence, having each recorded successful instances of this form of practice, but no good success in the majority of cases has to be recorded.

The best success has, however, followed the removal of the growth either by the application of a ligature or by excision. In 1867 I treated a boy aged 14, for a large cirroid aneurism of four years' growth situated on the right temple. It was supplied with blood by tortuous vessels converging from all quarters, and pulsated freely; I applied acupressure pins to all these vessels, even to their division without success; the growth for the time being flaccid, but rapidly reappearing and increasing. Under these circumstances I excised the growth, making my incisions at some distance from the margin, and ligaturing about twenty large vessels as I proceeded; a rapid recovery followed, and the boy was well three years later. In this case it was remarkable to see how rapidly the tortuous convoluted arteries that supplied the tumor withered and became of their normal size as soon as the tumor was removed, this process illustrating John Hunter's opinion that "vessels have a power of increase within themselves, both in diameter and in length, which is according to the necessity, whether natural or diseased;" and pointing out the fact that the attracting power had its centre in the growth, and not in the afferent arteries. In a second case, that of a girl *æt.* 12, I removed the growth by a subcutaneous ligature with like success; and more recently in a man who had such a vascular pulsatile growth in his left cheek, which had had all the afferent arteries tied without success before he came into my hands, I ligatured the whole mass subcutaneously, taking a wide scope of the disease, and a lasting recovery has taken place. Indeed the only successful cases of treatment of cirroid aneurism that I have had or seen have been those in which the growth itself was treated and removed.

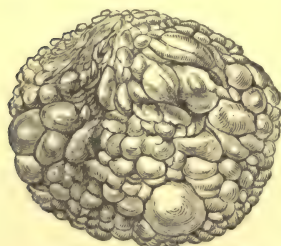
The cases of aneurism by anastomosis are very amenable to the treatment by styptic injection, the galvano-cautery, or the ligature.

Nævus, Telangeiectasis, Erectile Tumor, or Angeioma, is essentially a disease of the capillaries, seeming in a rough way to be made up of a mass of such a vascular tissue, the tubes freely intercommunicating with one another. It is true the walls of the vessels are indistinguishable in an advanced example of the disease, the nævus appearing as a collection of cells or spaces, opening widely into one another, through which blood flows. When the arterial supply is very free the growth appears florid, warm and pulsatile, it is then called an *arterial nævus*; when the venous element predominates the growth is less florid, has a congested bluish appearance and does not pulsate, this is called a *venous nævus*.

These growths for the most part appear in the skin or subcutaneous tissue, are frequent on the head and often multiple; although rare examples are on record where they affected deeper parts, even the viscera. In a clinical point of view they may be divided into the *cutaneous* or pure skin nævus; the *subcutaneous* or cellular tissue nævus; and the *mixed form* where both tissues are involved. This distinction has an important practical bearing. Nævi are as a rule diffused, that is, they have no distinct capsule, but in many cases they are encysted, and may be treated accordingly; venous subcutaneous nævi appear to be more frequently encapsuled than the cutaneous and arterial.

Nævi are, moreover, generally congenital or make their appearance soon after birth; they do occur, however, at a later period and then seem to be due to some injury or wound. At times these nævi grow rapidly, the cutaneous form rapidly spreading; the more florid and arterial the growth is the greater is its tendency to spread; the venous nævus is less progressive. They may grow also for a time and then stop; indeed they all have a tendency to become stationary after a period, and even to degenerate. It is not uncommon to meet with nævi that have begun to undergo this process before the birth of the child; and I could give many cases in which the nævus was ulcerated or even sloughing at birth. In feeble or cachectic children it is not uncommon for these "marks" to ulcerate or slough, and

FIG. 66.



Drawing, Guy's Mus., 160⁸⁴.—Hilton's case.

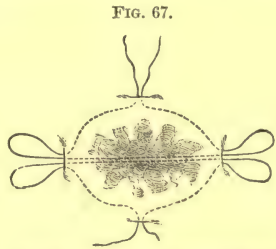
after measles, fever, or other depressing cause the destruction of the growth is sometimes very rapid. These facts show that nævi—although blood tumors—are not long-lived growths, and have an early tendency towards death. When they do not ulcerate or slough they undergo degenerative changes, and the most characteristic is the cystic degeneration. (Fig. 66.) When the skin undergoes this change the surface becomes warty and vesicular, the vesicles containing more or less blood-stained serum; when the cellular tissue is the part involved, cysts will still appear of a like nature, but at times the whole growth passes into a mass of cysts of different sizes bound together by fibre tissue. This degenerative change is very typical. To account for the formation of these cysts is no easy matter, indeed no satisfactory explanation of their production has yet been given.

Some nævi are pigmentary and are then called moles, they are far less vascular than the forms already alluded to, and have no such tendency to spread. They grow, it is true, with the growth of the subject, but in no greater proportion as a rule; in exceptional instances their increase may be rapid. They do not appear to have a tendency to ulcerate, slough, or undergo the cystic degeneration like the vascular nævi, but they have a

special tendency to become the seat of cancerous disease, and when cancerous of the melanotic form. That is, subjects who become the victims of cancer, and have moles, are often attacked primarily in such structures, and as the cancer originates in a pigmentary growth, it takes on its character and becomes melanotic. Cases illustrating this clinical fact are too numerous now to doubt its accuracy. I have seen very many of such.

TREATMENT.—Unless a nævus be so situated as to be an eyesore or an inconvenience, unless it shows positive evidence of its tendency to rapid increase, there is no necessity for operative interference; it will for a certainty, after a time, cease to grow, and will also for a certainty degenerate or waste; and under such circumstances it is not necessary to interfere. Should, however, the nævus be so situated as to be an inconvenience or a deformity; or should it grow so rapidly as to threaten to become either, something must be done, and this something is to be determined by the nature of the nævus and of the tissue in which it is placed. If *purely cutaneous* and not involving deeper tissues it may be destroyed by external application, such as caustics, nitric acid, or potassa fusa, chloride of zinc, or tartarized antimony. The former two being applied directly to the part; the latter two in the form of Vienna paste or otherwise. The actual cautery and the gas cautery are also very valuable destructive agents; but of all the galvanic cautery is to be preferred where it can be obtained, one touch of this steadily applied destroys the growth and with but little pain.

In the *purely subcutaneous nævus* the treatment by caustics or cautery is clearly inapplicable. When encysted, as they very often are, their excision is the best practice, saving the skin; when this practice cannot be followed they may be strangled by a ligature applied subcutaneously as illustrated in the drawing Fig. 67, or injected with the perchloride of iron, of the Pharmacopœia strength, with a solution of tannin in water in the proportion of ʒi to ʒi , or of the chloride of zinc grs. xij to ʒi of water, about twenty drops being thrown into the centre of the growth. The object of this treatment is to coagulate the blood in the tissue, and thus cause its consolidation and cure. In many cases injection causes inflammation, suppuration, or even sloughing of the growth, and although in this way a cure may be obtained, it is often by deformity.



Mixed nævus with the ligatures inserted round its base subcutaneously before being tied.

The great danger attending the treatment by injection is from embolism, more particularly when the nævus is on the head or trunk. I lost one patient from this cause in a few minutes after the operation. On that account it is a good practice to apply a ligature to the base of the growth, and then inject when the ligature is not enough to cause its destruction.

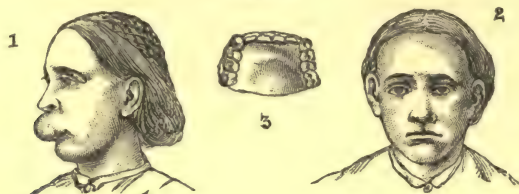
In the *mixed variety*, when the skin appears to have been involved secondarily by the extension of the disease from the cellular tissue, the nævus may be regarded and treated as the last form, that is, by excision, subcutaneous ligature or injection.

When the skin is extensively involved with the cellular tissue, and the nævus is defined, the whole may be removed by excision; when otherwise, by ligature. When the nævus is pendulous, or when it can be isolated from the parts beneath, excision is most applicable, and when hemorrhage is dreaded the base of the growth may be previously held in a flat clamp. In many instances I have excised the nævus by cutting on pins that have been inserted beneath its base; keeping the pins as points, round which a ligature

might be applied, and by which the edges of the wound might be brought together. When the thickness of the lip is involved in the disease and the disease is limited, a V piece may be taken out with the growth with advantage, and when the whole lip is involved the growth may be dissected out, leaving the skin. In the drawing below the operation was successfully employed.

The treatment of a diffused nævus by means of setons is a practice that can be strongly recommended. Several setons steeped in the solution of

FIG. 68.

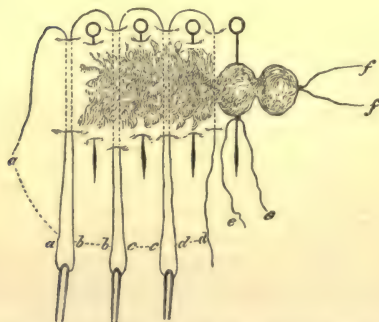


1. Nævus involving the whole of the upper lip.
2. After removal.
3. Flattening of the teeth from the pressure of the nævus (from "Guy's Reports").

the perchloride of iron are often sufficient to coagulate the blood or set up enough inflammatory action to cure the growth. In diffused mixed nævi this mode of treatment ought to be selected. When a nævus is extensive and is to be treated by the ligature, it may be dealt with piecemeal (Fig. 69); it occasionally happens that the ligaturing of half a nævus cures the whole by the extension of the inflammatory action. In nævi about the eyelids this suggestion is of value, several instances of cure having followed the application of a ligature to half the growth in my own practice.

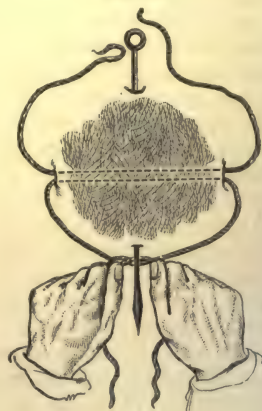
In a mixed nævus of moderate size when the cure by ligature is to be carried out, a pin may be passed beneath the growth and a needle at right angles armed with a double ligature (Fig. 70). The nævus is strangled in

FIG. 69.



Illustrating the method of ligaturing a large mixed nævus in sections around pins. At one end the pin has been removed, and the knot completed (f).

FIG. 70.



halves by the ligature tightly drawn beneath the pin; before the ligatures are finally tightened it is well to puncture the nævus to let out the serum and blood that it contains, to relieve tension, and to allow of the more per-

fect strangulation of the growth ; when this act is completed the pin may generally be removed.

Small *nævi* may be vaccinated, although the chances of a cure by such means are very poor. The same must also be said for compression.

The best needle for the application of a subcutaneous ligature to a *nævus* is figured below.

FIG. 71.



Richet, "Aneurism," in "Dict. de Méd. et de Chir. Prat.," vol. ii.—*Léon Le Fort*, "Diction. Encyclopédique des Sciences Médicale," 1866.—*Broca*, "Traité des Aneurysmes," 1856.—*Lisfranc*, "Des Différens Méthodes, &c., pour l'Obliteration des Artères," 1834.—*Scarpa*, "On Aneurism," Wishart's Translation.—*Bellingham*, "On Aneurism," 1847.—*Tufnell*, "On Treatment of Aneurism by Compression," 1851.—*Holmes*, "System of Surgery," 2d ed, 1870.—*Hodgson*, "On Arteries and Veins," 1815.—*Dr. Norris*, "American Journal."—*Dr. Stephen Smith*, Ditto.—*Erichsen's* Cooper's "Surgical Dict.," 1861.—*Wardrop*, "Cyclop. of Surgery."—*Syme*, "Observ. in Clinical Surgery," 1861.—*Fergusson*, Sir W., "Med.-Chir. Trans.," vol. xl.—*Dr. Jones*, "On Hemorrhage."

CHAPTER XXVI.

THE LIGATURE OF ARTERIES—SPECIAL ANEURISMS, ETC.

THE right way of securing a great artery is perhaps one of the most important points in practical surgery, wrote John Bell seventy years ago ; and to do this with nicety and precision requires a sounder and more accurate knowledge of anatomy than any other operation.

"Before undertaking to tie an artery, the surgeon ought to know its general course and its relations, and especially the prominent part or parts which are to guide him to the position of the vessel ; he ought to have familiarized himself by frequent dissection with the thickness of the parts covering it, and their appearance as far as that can be judged of in the dead body ; and finally, he ought to know the usual position of its principal branches, and the anastomosis by which the circulation may be expected to be restored. It is advisable also to be aware of the leading peculiarities in course, relations, bifurcation, &c., which the operator may perhaps meet with, and for which he ought to be prepared" ("Holmes's System," vol. iii, p. 545). In fact, unless anatomy be made the basis upon which the operation is conducted, any attempt to tie the trunk of a large artery must be surrounded with difficulties and fraught with danger, whilst so established it becomes in the hands of an experienced surgeon an operation of precision and apparent simplicity.

In a former chapter the mode of applying a ligature to a divided artery, after operation, was discussed and illustrated ; in the present, attention will be directed to the application of a ligature to an artery *in continuity*, as in the operation for aneurism or the arrest of hemorrhage from a punctured wound. To do this the surgeon has to go through several stages of thought as well as of action. He has *first* of all to make out with precision the *exact course of the vessel to be ligatured* ; this is done by the recollection

of the anatomical relations of the vessel, the muscular guides to its position, and the artificial linear guides with which he ought to be familiar.

He has, *secondly*, to decide upon *the point at which the ligature is to be applied*. When for a *wound* in the vessel this point is already settled, for it has been laid down as a rule, that whenever possible, a wounded artery is to be exposed at the seat of injury, and two ligatures are to be applied, one above and one below the seat of lesion.

When for *aneurism* the question is more open, the "point of selection" having to be determined by the surgeon. In deciding this important question, it is to be remembered that, if the ligature be applied *too near* the aneurism, there is a risk of the ligatured vessel partaking of the disease for which the operation is called for; and if *too far off*, the circulation through the aneurismal sac may be too free on account of the collateral circulation of the part, and thus interfere with or prevent recovery taking place.

But above all, the surgeon should avoid selecting a spot *where an artery bifurcates, or gives off large branches*; for under these circumstances, the clot that is required to plug the vessel behind the ligature must be absent, and one of nature's most important hæmostatic agents will be lost.

With the decision of these primary important points, the operation itself has to be considered, and this resolves itself into *the exposure of the artery, its isolation, the application of the ligature around it, and the after-treatment*; the position of the patient for operation having a prior consideration.

The position of the patient should be such as to render prominent the anatomical guides to the course of the artery; to make the skin tense to facilitate its division, and to be easy to the patient *it should be one of extension*. But these ends having been secured, and the artery exposed, it is well to remember that the muscles of the part should always be *relaxed*, the artery being better brought into view by these means, and the subsequent steps of the operation rendered more easy.

The exposure of the artery is to be made by incision, its course having been clearly made out beforehand, and the point for the application of the ligature determined. The incision should be in the course of the vessel, its centre corresponding to the point where the ligature is to be applied, an occasional obliquity being sometimes practiced when the exact position of an intermuscular interspace, where the vessel lies, is somewhat uncertain, and the artery deep. It should, moreover, be free. In a thin subject it need not be so long as in a fat one, nor in a superficial artery as in a deep; but, under all circumstances, the skin wound should be enough to allow of a free exposure of the vessel that is to be ligatured, and room for manipulation.

The first incision should include the skin and superficial fascia down to the deep fascia, and in making it the operator has only to avoid the division of any large vein, such as the external jugular, in operations on the neck, or saphena, in operations on the thigh. He should, consequently, mark out their position by arresting the circulation through them on their cardiac side, and make his incision by their side when they lie in his course.

When the deep fascia is exposed, it is to be laid open, and in this step the use of a director is sometimes of value; the fascia is, moreover, always to be divided to the full extent of the external incision. The student should remember, that the trunks of all arteries, except the cutaneous, are covered in by fascia. With the division of the fascia, the use of the knife may for a time be dispensed with, for the intermuscular septa and cellular

tissue are readily separated with the handle of the instrument or finger, and the sheath of the vessel is well exposed.

If immediately after the first incision, writes Malgaigne, the surgeon attempts to find the artery, he tries an impossibility, since he cannot reach it till after the last incision. He will then proceed uncertainly, and at random—whence the following rule of the guiding points: "The surgeon should not at the commencement occupy himself with looking for the artery, but should seek the first marked point of guidance, then the second, then the third, and so on to the end."

In looking for the sheath, every anatomical guide is to be made use of to prevent undue separation of parts and manipulation.

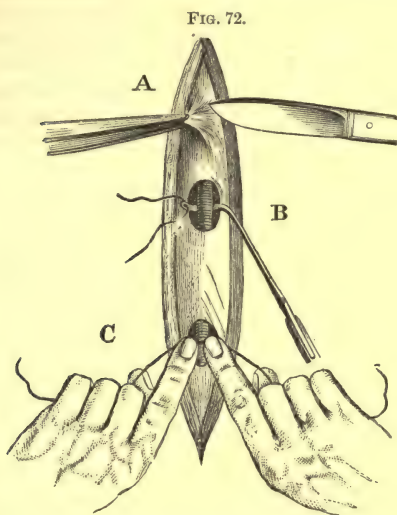


FIG. 72.

FIG. 73.



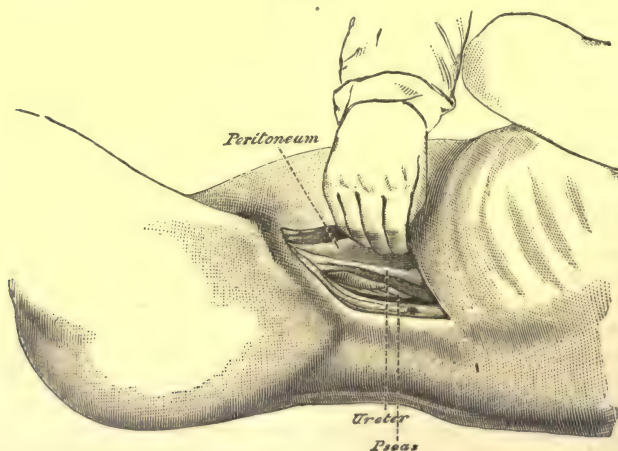
This diagram represents three distinct operations.
A. Opening the sheath. B. Drawing ligature round the artery.
C. Tying artery.

When the sheath is found, and the pulsating artery is felt within, the end of the operation is not far off. Still many errors may be committed. Every possible error should consequently be thought over beforehand, in order that it may be avoided. The operator must ask himself as to the position of the nerves and veins about the part, in order to avoid them. He need not look for them, as he would in a dissection, for this would necessitate unnecessary manipulation, but their existence must be present in his mind. He need only remember their relative position to the vessel where the ligature is to be applied, and guard against their being injured. The sheath having been found, it is to be raised by the forceps, and carefully opened (Fig. 72, A), the opening being only sufficient to admit a probe or aneurism needle, for the less the sheath is separated from its vessel the better. The needle (Fig. 73) with the ligature is then to be passed (Fig. 72, B), and it is well to introduce the needle between the artery and the vein, for when it is passed the other way the vein may be perforated or mistaken for fascia; but this point in the hands of a careful surgeon need not weigh against convenience. With the exposure of the artery all anxiety ceases, for to put an ordinary silk, hemp, or catgut ligature around it is a comparatively easy task with the majority of arteries; and when this is

done the operation, as such, is nearly completed. To do this, however, the surgeon must be careful not to elevate the artery from its bed by the ligature, but to tie the knot with his fingers well passed down to the vessel (*vide* Fig. 72, c). He should also satisfy himself when the vessel is on the needle that pulsation exists, and that pressure upon it arrests pulsation in the aneurism. When the ligature has been applied, the displaced parts must be readjusted, the wound cleansed, its edges brought together, and some light dressing, such as water-dressing, put over it. When the artery of an extremity has been tied the limb should be raised, to facilitate the venous circulation, and cotton-wool wrapped round the part to maintain its heat, but beyond this no local treatment is required. It need hardly be said that chloroform should always be given in these operations, and that the subsequent treatment of the case should be based on general principles. When veins bleed or when large venous trunks must be divided, they may be tied or twisted, but gentle pressure often arrests bleeding from small vessels. The wound is to be carefully sponged clean during the operation by the firm pressure of a well-squeezed sponge, and the edges are held apart after the sheath has been exposed by hook directors, but the surgeon should on no account allow his assistants to draw the parts so asunder as to make them lose their relative positions. With these general remarks, the application of a ligature to special arteries will now claim attention.

Ligature of the Abdominal Aorta.—In 1817 Sir A. Cooper tied the abdominal aorta, having failed to find the communication between the common iliac artery and an aneurismal tumor after the introduction of his finger through a small opening in the ruptured sac. He made his incision through the linea alba to the left of the umbilicus, directly over the aorta. The patient lived forty hours. James, of Exeter (1829), and Murray, of the Cape of Good Hope, followed his example with no better success, the patients surviving three and a half and twenty-three hours respectively.

FIG. 74.



In 1842 ("Lancet," p. 334) Dr. C. B. Monteiro, of Rio Janeiro, recorded a case in which the patient died from hemorrhage on the tenth day. In 1856 Mr. South ("Lancet," vol. ii) operated on a patient who lived forty-three hours. In 1868 ("American Journal of Medical Science") Dr. McGuire, of Richmond, Virginia, recorded a sixth case, in which the patient lived

twelve hours; and in the "Dublin Quart." for 1869 Mr. Stokes, junior, a seventh, in which a temporary ligature was applied, but without success.

In all these cases the operation was performed for aneurism of the common iliac artery, but the success that has hitherto followed the operation is a poor encouragement for its repetition, more particularly when we have other means at our command that hold out a better promise of success, such as pressure by the abdominal tourniquet, with the patient under the influence of chloroform.

Dr. Murray, of Newcastle-on-Tyne ("Rapid Cure of Aneurism by Pressure," 1871), Dr. Heath, of Sunderland ("Brit. Med. Jour.," 1867), and Mr. Holden ("St. Barthol. Hosp. Rep.," 1866), have recorded cases of cure of abdominal aneurism by these means.

The best incision to reach the abdominal aorta is a modification of that adopted by Sir P. Crampton for the common iliac artery (Fig. 74), one extending from the anterior superior spinous process of the ilium of the left side to the cartilage of the tenth rib, turning up the peritoneum. The great difficulty in the operation is in the application of the ligature to the vessel.

Ligature of the Arteria Innominata.—The first operation was by V. Mott, of New York, in 1818, and since then this artery has been tied twelve times, but only once with success, and in that case, by Dr. Smyth, of New Orleans, in 1864; the carotid and vertebral arteries were likewise ligatured, the former at the same time, the latter one month afterwards for secondary hemorrhage. Dr. Smyth did this on the suggestion made by Mott in 1818, when he wrote, "By thus intercepting the retrograde current through the primitive carotid there would be less chance of any reflux hemorrhage in the event of a phagedænic ulceration taking place in the wound." In all the other cases a fatal result rapidly occurred. It can only be entertained, therefore, in traumatic cases of injury to the carotid or subclavian near their origin, or in exceptional cases of disease.

Operation.—The head being thrown back to the left, and the shoulder depressed, the vessel may be secured by making an incision along the anterior border and sternal origin of the sterno-mastoid muscle; or by a transverse one over the upper border of the clavicle, making its centre correspond to the upper border of the sterno-clavicular joint; or by both combined. Under all circumstances, the sternal, and sometimes a part of the clavicular, origin of the muscle will require division. The carotid artery with its sheath will then come into view, with the internal jugular vein on its outer side, and the vagus nerve between. On tracing these downwards, the innominate vessel will be reached. In a healthy subject the artery is always to be found behind the right sterno-clavicular joint, but in disease its relative position may be altered by mechanical displacement. Dr. Cooper, of San Francisco, has reached the artery on two occasions by removing the sterno-clavicular articulation.

In **Aneurism of the Innominata** there is no possibility of applying a ligature to its cardiac side, even if the disease involved so little of the artery as to admit of the practice being entertained, for as a rule this form of aneurism is associated with dilatation of the aorta.

The distal operation, however, may be thought of, the carotid and subclavian arteries being ligatured simultaneously or consecutively; out of four instances in which the former practice was followed one recovered, and out of three of the latter an equal success may be recorded.

The credit of the successful case in the former class, for a success I take it to have been, belongs to Mr. Heath, who tied the subclavian artery in the third part of its course and the common carotid simultaneously in 1865.

The operation was followed by marked relief and the diminution of the tumor; the woman, *æt.* 30, survived the operation four years, and died from rupture of the aneurism. After death the aneurism was found to be of the aorta, the innominate being only slightly involved. (*Vide* Prep. in Mus. of Royal Col. of Surgeons, and "Path. Trans.," vol. xxi.)

The successful issue to the case in the latter class belongs to Mr. Fearn, of Derby, who tied the carotid in 1836, and the subclavian in the third part of its course two years later for innominate aneurism. The patient died four months after the second operation from pleurisy. I had an opportunity in 1866 ("Path. Soc. Trans.," vol. xviii) of carefully examining and reporting on this preparation, which is now in the College Museum, and a better specimen of a cured small sacculated aneurism could not possibly be seen.

Aneurism of the innominate has likewise been treated by ligature of the subclavian or common carotid alone, Wardrop's operation; and in "Holmes's Surgery" a most interesting list of references to such cases, collected by Mr. Heath, is to be found. Out of eighteen cases, Evans's case, as recorded by Wardrop, was cured; his own lived two years, Morrison's case lived twenty months, two other lived six months, and the rest lived only a few days or weeks.

In August, 1871, I ligatured the subclavian in a man, *æt.* 33, for this affection, and a rapid convalescence followed, with great diminution and consolidation of the aneurism. The man is still alive. This result, then, is not so discouraging as to preclude the question of operation in favorable cases. It can only, however, be entertained under exceptional circumstances, and then as palliative rather than curative treatment.

Ligature of the Common Carotid Artery may be demanded for aneurism or erectile tumors of the trunk itself, or one of its branches, in the orbit, on the scalp, &c., and for wounds and hemorrhage. It is a dangerous operation, and sometimes a difficult one, but in a moderately thin subject it may be performed with facility; it is only to be done when all other means of treatment are inapplicable or have been found ineffectual, and for aneurism it ought not to be performed unless the treatment by digital compression has been rejected. The vessel may be ligatured in the upper part of its course, at the apex of the carotid triangle, in a line with the cricoid cartilage, or nearer its origin; the former position is the better and easier of the two, and for disease of any of its branches it should be selected. The latter should only be employed for disease or wound of the upper part of the trunk itself. The course of the artery can always be made out, corresponding as it does with a line drawn from the sterno-clavicular joint to the angle of the jaw; it divides at a line on a level with the upper part of the thyroid cartilage, and should be tied opposite the cricoid. The centre of the incision should consequently correspond to this point; and it should be made about three inches long along the anterior margin of the sterno-mastoid muscle. The position of the patient should therefore be such as to render this muscle prominent, which is insured by the extension of the head backwards, the face being turned to the opposite side.

Before making the first incision through the skin, platysma, and superficial fascia, the surgeon should assure himself that no large vein, such as the anterior jugular, is likely to be divided; gentle pressure below, enough to interfere with the venous circulation of the part, readily gives this information. The deep fascia covering in the sheath of the vessel may then be divided, care being taken to do this to the whole extent of the external wound. The sheath of the artery will then come into view, lying between the trachea and sterno-mastoid muscle; the pulsation of the vessel may

likewise be detected. The head of the patient at this stage of the operation should be gently raised, so as to relax the sterno-mastoid muscle, and allow of its being gently drawn out by means of a retractor and the separation of the cellular connective tissue of the part. The anterior belly of the omohyoid muscle will then probably be at once visible, with its fibres passing downwards and outwards, and when this muscle is broad it will cover in a great part of the vessel. The descendens noni nerve may likewise be seen lying upon the sheath, sometimes it lies within; it need not be looked for, although care is to be observed that it is not wounded or included in the ligature; should it be in the way, it must be gently held aside by a retractor, as should any large vein that crosses the sheath. The inner border of the sheath is then to be taken up with forceps, and firmly held, a sufficient opening being made in it by the knife, held with its flat surface towards the artery, to allow of the introduction of the aneurism needle; the needle is generally recommended to be passed *armed*, but this is not a point of importance, and *unarmed* it is passed with greater facility; by a little manipulation the needle may then be passed round the artery from without inwards, introducing it between the vein and vessel, its point being kept close to the artery. The sheath may then be dropped from the forceps, the loop of the ligature seized or needle threaded, and the needle withdrawn. The surgeon should, however, satisfy himself beforehand that the right vessel has been exposed, and that the vagus nerve is not surrounded. The vessel may now be tied, great care being observed that it is not raised from its bed or manipulated more than is necessary; the knot should be tightened by the index fingers passed well into the wound. The wound should then be adjusted and the patient put to bed, the most perfect quiet being enjoined. The surgeon must remember all through this operation that the jugular vein is on the outer side of the artery, and often overlaps it; that the vagus nerve is behind, and the descendens noni in front (Fig. 75). None of these parts need, however, be looked for as long as care is observed that they are neither wounded nor included in the ligature.

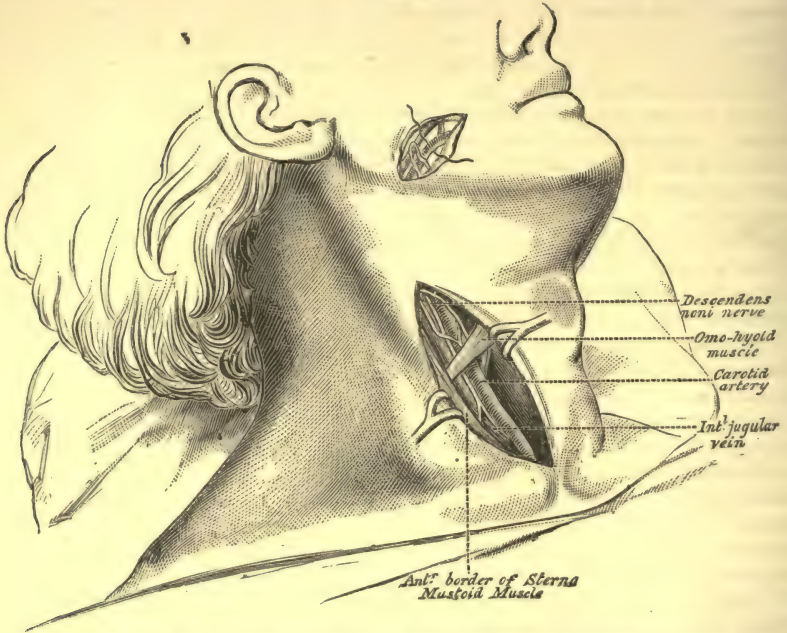
The operation for ligaturing the *lower part of the carotid* is very similar to the above; the operation is more difficult from the vessel being deeper, particularly on the left side. The incision should, however, extend lower down over the sterno-clavicular articulation. The muscles will also require more retraction, and probably some division. The ligature will probably separate about the fifteenth day, but at times the period will be longer; till that day the less it is disturbed the better, the gentlest traction only being applied to draw it out of the wound. Should its discharge be, however, retarded, the ligature may be twisted daily on its own axis, to facilitate its separation, but this is to be done with extreme caution.

Mr. Cock has related to me a case, which he authorizes me to quote, in which Mr. Aston Key applied a ligature to the left carotid for aneurism and the man died on the table; simply dying on the application of the ligature. After death it was found that the right carotid had been previously obliterated, the operator having, by ligaturing the left, cut off the supply of blood to the brain, and thus caused death. Such a case as this is unique, and deserves a place in the records of our profession.

With respect to the prognosis after this operation, much depends upon the object for which it is performed. Dr. Pilz, of Breslau, whose statistics are the most recent ("Langenbeck's Archives," 1868), makes out that 43 out of every 100 die. That of 228 cases in which the operation was performed for hemorrhage, 128, or 56 per cent., were fatal; of 87 for aneurism, 31, or 35 per cent., died; of 142 for tumors, 49, or 34 per cent., died;

of 71 for extirpations, 25 died, or 35 per cent.; of 34 for affections of nervous system, one only died, or 3 per cent.; and of 38 for aneurism, on the distal or Brasdor's method, 25 died, or 65 per cent.

FIG. 75.



(This figure, with many others in this chapter, is based upon those given in Sedillot's work.)

Secondary hemorrhage is a common cause of death, but brain complications are more frequent, abscess in the brain and atrophic softening, from want of arterial supply, being the usual form—local gangrene, as it were, of the brain. Brain symptoms in some of their forms also frequently occur after the operation, when death does not take place simply from altered cerebral circulation. Suppuration of the aneurismal sac is not infrequent; in a case of my own it was the cause of death.

Ligature of the External or Internal Carotid Artery is very seldom performed, the ligature of the common being preferred. In certain wounds of these arteries near their origin, a ligature may, perhaps, be placed upon them, but the uncertainty of the position of the bleeding point renders the ligature of the common trunk preferable. Indeed, the ligation of the internal carotid artery may be said to be abandoned.

Should the surgeon be called upon to tie the external carotid, he may do so by adopting the same rules as have been given for the common carotid; the incision should, however, be higher up. The course of the vessel follows the same line as the common carotid, starting from the upper part of the thyroid cartilage.

The Lingual Artery has been ligatured for wounds of the tongue and of the artery itself, to check the growth of cancerous tumors, or arrest hemorrhage from their substance, and the operation is a difficult one. The trunk of the vessel is always to be found at a point *above the great cornu of the hyoid bone*, and this point must be rendered prominent by the head being

well drawn over to the sound side. The best incision is a horizontal one, on a level with the hyoid bone, its centre corresponding to the end of the greater cornu. The skin and fascia having been divided, the submaxillary gland will become exposed. On hooking this upwards the lingual nerve will be seen resting on the hyoglossus muscle. Behind this muscle, and at a lower level than the nerve, the artery will be found. It will be in close contact with the tendon of the digastric muscle. The fibres of the hyoglossus will always require division to allow of the ligature being applied. Fig. 76 illustrates these points.

A good paper on this subject, by M. Demarquay, may be referred to, "Gaz. Méd. de Paris," 1867.

The Facial Artery is always to be found close to the anterior border of the masseter muscle. It is only covered in by skin, platysma, and fascia; a transverse or oblique incision at the lower insertion of the muscle will expose the artery, where it may be ligatured. (*Vide* Fig. 75.)

It is difficult to understand under what circumstances this operation can be called for, the artery being so readily controlled by pressure, an acupuncture needle and twisted suture over it being probably the best form.

The Temporal Artery can always be found and pressed upon in front of the pinna of the ear, over the zygoma. It lies buried in the dense cellular tissue which exists in this spot beneath the skin and fascia. It can be readily exposed by a vertical or oblique incision, an inch long, one-third of an inch in front of the tragus.

The Occipital Artery can be traced by a line drawn from the mastoid process to the occipital protuberance; it lies beneath the skin and cranial aponeurotic origins of the sterno-mastoid and splenius muscles, and these must be divided to reach the vessel. The artery can be felt about the centre of the line mentioned.

Ligature of the Subclavian Artery in the *first part* of its course has been performed about seven times, but never with success; it is an unscientific as well as unsuccessful operation, and for disease it is scarcely a justifiable proceeding; for a wound it may perhaps be entertained. The incision for the operation would be similar to that for the innominate.

The point usually selected for the application of a ligature to the subclavian is in the *third part* of its course, where the artery emerges from behind the scalenus muscle, and this operation may be demanded for aneurism of the axillary artery or for a wounded vessel.

Aneurism may affect the subclavian artery in any part of its course; it may involve the whole of the artery, or it may be confined to its first or third portion. When situated on the artery to the inner side of the scaleni muscles, it may be mistaken for an innominate or aortic aneurism, or a common aneurism may involve all these vessels on the right side of the body. When affecting the artery external to the scaleni, it most frequently is associated with disease of the axillary artery.

The diagnosis of subclavian aneurism is consequently by no means easy; it is thus referred to by Nélaton:

"In subclavian aneurism the tumor extends generally externally to the clavicular origin of the sterno-mastoid muscle, reaching the posterior and inferior triangle of the neck; becomes more elongated transversely than vertically; the bruit is propagated more towards the axilla than the neck, and remains the same on compressing the carotid; the radial pulse enfeebled; the limb painful and œdematous, and incommoded in its movements. In carotid aneurism the tumor is seated between the sternal and clavicular origins of the sterno-mastoid muscle, becomes more elongated in a vertical direction than a transverse one, and on auscultation gives to the

ear a *bruit de souffle*, which is propagated more towards the side of the neck than the arm, with diminution of the arterial pulsation in the corresponding side of the face and cranium, and without weakening the radial pulse on the same side. In innominate aneurism the tumor is placed under the sternum, or at the inner border of the sternal portion of the sterno-mastoid muscle, with weakening of the pulse in the subclavian and carotid arteries, and with absence of the other signs peculiar to the two other forms."

The prognosis must always be regarded as unfavorable, for these aneurisms are peculiarly liable to become diffused, even in the early stage of their development as a visible tumor; yet there are several instances on record of their slow progress, and in some cases fortunate examples of their ultimate cure by natural efforts.

The treatment of these aneurisms is highly unsatisfactory; operative measures are so limited and constrained that the surgeon is beset with difficulties in seeking a point by which he may attack the disease. Ligature of the first portion of the subclavian, ligature of the innominate, the distal ligature of the subclavian and axillary arteries, and ligature of the carotid, have all been performed, and with one exception have been attended with fatal results. The exceptional case is that of Dr. Smyth, of New Orleans, who tied the innominate and carotid, and subsequently the vertebral artery on the fifty-fourth day.

It is only in small aneurisms, occupying the third portion of the artery and the commencement of the axillary, that the operation of tying the subclavian external to the scaleni has been successfully performed, and in some of these instances the outer fibres of the scalenus anticus muscle have been obliged to be divided.

Amputation at the Shoulder-joint on the distal side of the aneurism has been suggested by surgeons for the cure of the disease. It has been successfully performed by Professor Spence, of Edinburgh.

Galvano-puncture has been successful in one case by Abeille; and *escharotics* in another case by Bonnet. *Manipulation* has been employed by Ferguson in two cases, and by Liddell in one case, with satisfactory results in the latter one only. A case of Porter's may also be accepted as a successful one. *Direct compression* on the aneurism has been tried by Warren, and with a favorable issue, although much danger was risked in the proceeding. Corner's case, although one not actually of the same kind, was a very good instance of the value of protecting an aneurism from enlarging, and exerting such moderate compression as to incite fibrinous deposition in the fluid aneurism. Poland's case of success from *pressure on the artery* on the cardiac side of the aneurism is quite an exceptional case. Gay has recently apparently also met with success. The use of *acupressure* by Porter, although successful on the distal side of the aneurism, proved fatal when applied on the cardiac side on the innominate artery, and *injection into the sac* was performed in one case with fatal result. Langenbeck has recently injected the parts over the aneurism with a *solution of ergotin*, the object being to cause contraction of the aneurismal sac. Such is a list of the means which have been resorted to, but the success has been so poor that the question naturally arises whether we should not discard such measures, and treat these aneurisms on the ordinary principles of internal aneurisms, by rest, attention to diet, &c.

Mr. Poland, in the "Guy's Reports" for 1870, in an admirable essay, gives a very favorable return of cases which he has been able to collect in reference to this point. It stands thus:

Out of 13 cases which underwent *general and local treatment* 7 recovered, 1 was relieved, and 5 died; out of 22 cases in which an expectant treat-

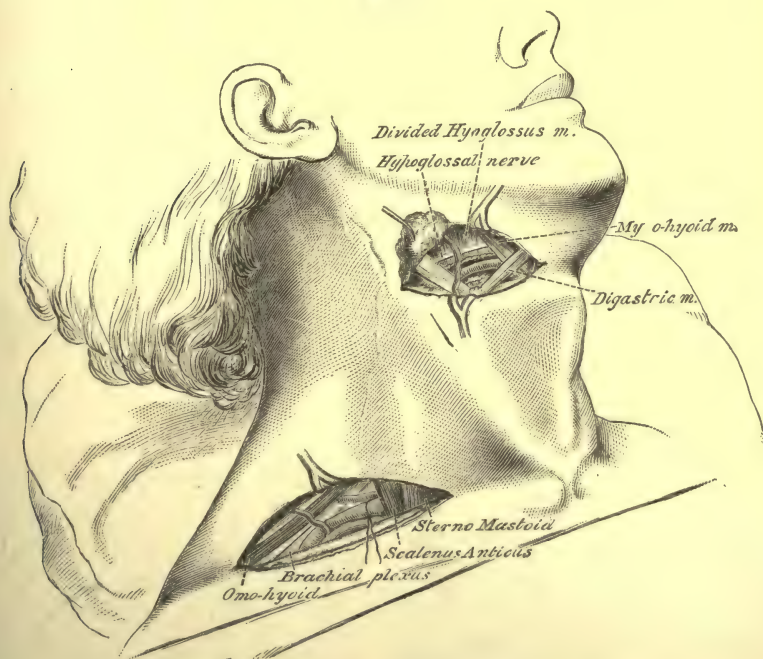
ment only was pursued, 4 recovered and 18 died; thus giving a total of 11 recoveries and 23 deaths, 1 being relieved. Of the 23 fatal cases the duration of life was noticed in 17.

In 21 cases in which the subclavian artery was ligatured in the *third part of its course* for aneurism, 9 recovered (in 6 of these it was the left artery that was ligatured) and 12 died; 8 of the deaths were due to hemorrhage, and 4 to brain complications or other symptoms. Poland's facts thus accord well with Koch's, who gives 36 recoveries out of 65 cases, something less than half dying, a success which is certainly encouraging to induce surgeons to undertake the operation.

The Operation.—It has been already stated that the application of a ligature to the subclavian in the first part of its course is hardly a justifiable operation; should it be undertaken, the incision on the right side would be similar to that for the innominate, on the left side it is scarcely practicable on account of its depth and relations.

In the *third part* of its course the operation is to be performed as follows, both sides being alike. The patient should be raised upon a pillow, with his head thrown back and face turned to the opposite side, an assistant drawing the arm down as much as possible to depress the shoulder. An incision three or four inches long should then be made along the upper surface of the middle of the clavicle (Fig. 76); not above the bone, as the

FIG. 76.



external jugular vein might then be wounded. Some surgeons advise the skin to be drawn down from the neck upon the clavicle, so as to diminish this risk. In this incision the skin with the superficial fascia and platysma will be divided. The deep fascia will then be seen with the external jugular vein coursing over it. This must be held aside with a retractor; when its

division is a necessity it should be done after the application of two ligatures, one above and another below the line of section. The cervical fascia is then to be divided the whole extent of the wound; this must be done with care on a director; should more room be wanted, a portion of the sterno-mastoid or trapezius muscle may be divided. The knife is now to be laid aside, and the artery looked for in the space exposed, separating the parts with a director or the handle of the scalpel. It will be found just on the outer side of the scalenus anticus muscle, the edge of which can generally be felt, and behind the tubercle on the first rib, that can almost always be made out. Several arteries of large size will probably be found crossing this space, and many veins. The supra-scapular artery and vein will always be seen behind the clavicle. The brachial plexus lies external to and behind the subclavian artery, the subclavian vein in front and below. When the vessel is seen or felt the sheath is to be opened, and the aneurism needle passed around it from below upwards, care being taken not to injure the vein or include a nerve.

Ligature of the Axillary Artery is a rare operation, although it may be demanded for some wound of the vessel or aneurism of the brachial. It may be performed in two positions, either below the clavicle or in the axilla.

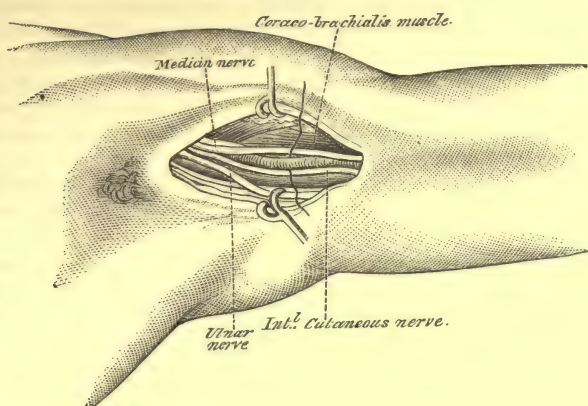
The Subclavicular Operation is carried out by an incision made immediately below the bone from the coracoid process to its sternal end, dividing integument and fascia, but carefully avoiding the cephalic vein that runs along the anterior border of the deltoid to join the axillary. The clavicular origin of the pectoral muscle may then be divided, and the deep fascia or costo-coracoid membrane covering in the sheath of the vessels exposed. In this step of the operation some of the branches of the thoracic acromial artery will come into view, and if wounded must be secured. The coracoid insertion of the pectoralis minor may also be seen. The fascia covering in the vessels will then be exposed, and on laying it open the greatest care is needed, for the axillary vein lies immediately beneath it, and above this will be found the vessel resting on the first intercostal muscle. The brachial plexus is above and behind. The axillary vein must be drawn downwards, and the aneurism needle passed from below upwards, care being observed not to include the external respiratory nerve of Bell that passes behind the artery. When the vessel has been exposed, the passage of the ligature will be facilitated by bringing the arm down to the side of the body. On the dead subject this operation is not difficult, but the number of veins and arteries that exist in the space must render the operation on the living far from easy.

To Tie the Axillary Artery in the Axilla, the arm should be well raised upwards, and the course of the vessel marked out slightly posterior to the middle line of the axilla. An incision should then be made along the inner margin of the coraco-brachialis muscle through the skin and fascia for about two or three inches, and the deep fascia exposed. These should be carefully divided to the whole extent of the wound, when the artery with its attendant nerves and veins will come into view. In this stage of the operation the forearm should be flexed on the arm to relax the parts. The vessel, as a rule, has the median nerve at its outer side, between it and the coraco-brachialis muscle, the vein and ulnar nerve within. The internal cutaneous nerve is in front. (*Vide Fig. 77.*)

Mr. Guthrie condemned the subclavicular operation altogether, and advised the surgeon to expose the artery by an incision three inches long carried upwards along its course, commencing at the lower border of the pectoral muscle; but few surgeons have followed this advice, most men

preferring the operation named subclavicular, one of its modifications, or the ligature of the subclavian.

FIG. 77.

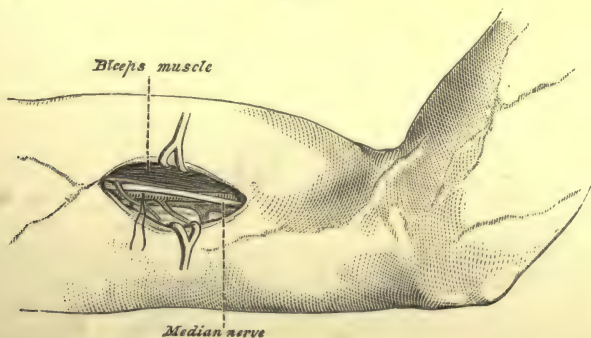


Mr. Erichsen prefers for the superior operation an incision made from the centre of the clavicle downwards in the course of the vessel to the middle of the anterior fold of the axilla, this incision necessitating the division of the great pectoral muscle, and often of the small. He says that this division need not leave any permanent weakness of the limb, as by proper position ready union may be effected between the parts.

In all these operations on the axillary artery the surgeon must be on the look out for abnormal division and relations.

Ligature of the Brachial Artery may be demanded for direct injury to the vessel, hemorrhage from a wound of one of its divisions in the hand or forearm which cannot be treated locally, aneurism, &c., and it may be performed readily in any part of its course. The middle of the arm is the point of election. The course of the vessel is indicated by a line drawn from the middle of the axilla to the inner side of the biceps tendon at the bend of the elbow, and the inner border of the biceps muscle is the guide to the incision. The vessel may be exposed by a cut two to three inches

FIG. 78.

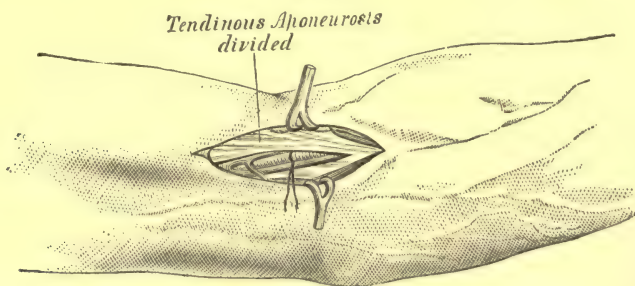


long made in this position, with the arm extended and supinated. The skin, which is always thin, and the fascia, should be carefully divided, and the deep fascia exposed. This is next to be laid open, but with care, for

the basilic vein lies immediately below it, on the inner side of the brachial artery. The ulnar nerve will be found on the inner side of the vein, and the median in front of the artery, but there is no regularity in these relations; much care is consequently required in finding the vessel, and discretion in tying it, for a high division of the vessel or some vas aberrans may exist to mislead and confuse. When the right vessel has been found the application of a ligature is readily concluded. In performing this operation the surgeon must be careful not to open the sheath of the biceps muscle, and he should remember to flex the forearm on the arm after the division of the deep fascia has taken place.

Ligature of the Brachial in its Lower Third is now rarely performed; in the days of bleeding it was by no means infrequently required for traumatic aneurism, but it has never fallen to my lot to witness its performance for such a cause. The operation may be performed with the forearm extended, by making an incision two and a half inches long on the inner side of the tendon of the biceps, care being taken to avoid the large veins that ramify in the superficial fascia. The tendinous aponeurosis of the biceps

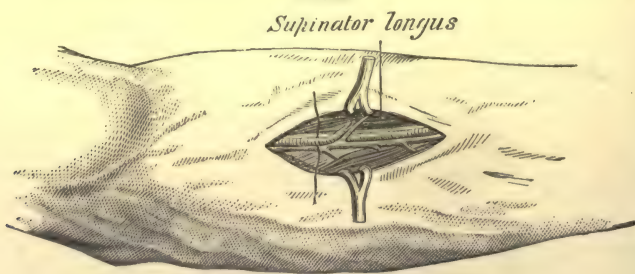
FIG. 79.



will then come into view, and on its division the artery will be exposed with its venæ comites, the tendon of the biceps being on its outer and the median nerve on its inner side. The forearm should then be flexed after the artery has been exposed, when a ligature can be passed without trouble.

Ligature of the Radial Artery.—A line drawn from the *outer* side of the biceps tendon at the bend of the elbow to half an inch internal to the

FIG. 80.

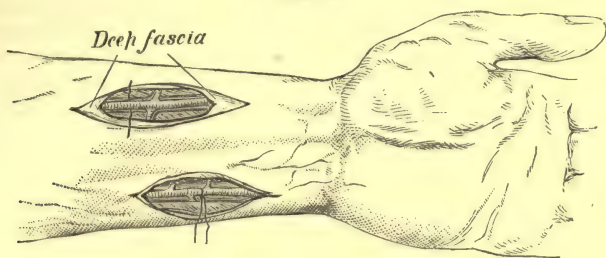


styloid process of the radius at the wrist, marks out with sufficient clearness the course of the radial artery, and the vessel may be tied in any part of it. In the upper third of the forearm (Fig. 80), between the supinator longus on the outer and pronator teres on the inner side, it may be found

by an incision two inches long made in the line above mentioned, dividing the integument and deep fascia, care being taken not to divide the large cutaneous veins unnecessarily; on separating the muscles with the handle of the knife, the forearm being partially flexed, the artery will be brought into view with its *venæ comites*, the nerve being to its outer side. A ligature will then be readily passed around the vessel. I have had to cut down upon the radial artery in this part of its course for a traumatic aneurism, the result of a punctured wound, when I divided the vessel and twisted both ends, a speedy convalescence following.

At the lower third the vessel is to be found external to the flexor carpi radialis muscle, but internal to the supinator longus; it lies beneath the

FIG. 81.



deep fascia, and on the division of this artery can readily be found (Fig. 81). On the dead subject the principal cause of difficulty in applying the ligature lies in the fact that students look for it too superficially, mistaking the superficial radial vein for the deep. I have had to ligature the radial above the wrist, on three occasions, for aneurism; in two for traumatic aneurism situated in front of the wrist, and in the other for aneurism on its dorsal end. In all a good result ensued.

Ligature of the Ulnar Artery.—This vessel lies beneath the superficial layer of muscles in the upper half of its course, and in the lower it is to be found between the tendons of the flexor carpi ulnaris on the inner side and flexor sublimis digitorum on the outer, being covered in with integument and deep fascia. Its position is roughly indicated by a line drawn from the inner side of the biceps tendon to the radial side of the pisiform bone, the upper part of the vessel describing a curve with the concavity outwards.

To ligature the artery in the upper half of its course an oblique incision may be made crossing the line above indicated and the radial border of the flexor carpi ulnaris found. Through this the incision must be made, when the artery will be seen between the two layers of muscles. This operation is a very difficult and uncertain one, and it is an open question whether it is a sound one. I am disposed to think that the brachial had better be tied under all circumstances rather than have recourse to it.

To Tie the Ulnar above the Wrist is not more difficult than to tie the radial (Fig. 81). An incision along the outer side of the flexor carpi ulnaris, dividing skin, superficial and *deep* fascia, will expose the vessel, with its *venæ comites*, and the nerve on its inner side. A ligature is easily passed round it. The drawings will illustrate these points.

Hemorrhage from the Palm of the Hand is always alarming and troublesome, more particularly from a punctured wound. In a superficial incised wound the vessel may generally be found and ligatured or twisted, but from a deep it is neither expedient nor justifiable to cut into and explore the palm for the purpose.

When the vessel cannot be tied, therefore, a graduated compress may be applied over the wound, and the fingers flexed and bound down over a ball or block of wood, the arm being well raised in a vertical position, and this should not be undone for at least five or six days. Should these means fail, which they rarely do when efficiently employed, the radial and ulnar arteries may be compressed with acupressure needles, and should this not succeed the application of a ligature to the brachial artery may be called for. In neglected cases, where the parts are all infiltrated and boggy, this practice may be called for at once. It would be well, however, before resorting to this practice, under all circumstances, to try extreme flexion of the forearm upon the arm, with forced supination of the hand, with or without a pad at the bend of the arm; for it is now well known that by this position the circulation through the brachial artery can be completely arrested; indeed, under all circumstances, whether for injury or disease of the arteries of the hand and forearm in which surgical interference is called for, it would be well to bear this treatment in mind; it is most effective. It is well to know, however, that repeated hemorrhage may take place from the palm of the hand from the presence of a sloughing tendon. I have recently had, with Dr. Bunney, of Newbury, a very interesting case illustrating this, in which a gentleman, æt. 33, had his middle finger bent so forcibly back by a cricket ball as to cause rupture of the integument in front of the extreme joint, and laceration of the flexor tendons of the finger about the wrist. Suppuration and sloughing of the tendons followed, attended by repeated attacks of palmar hemorrhage, which ceased at once on the removal of the dead tendons.

LIGATURE OF ARTERIES OF THE LOWER EXTREMITY.

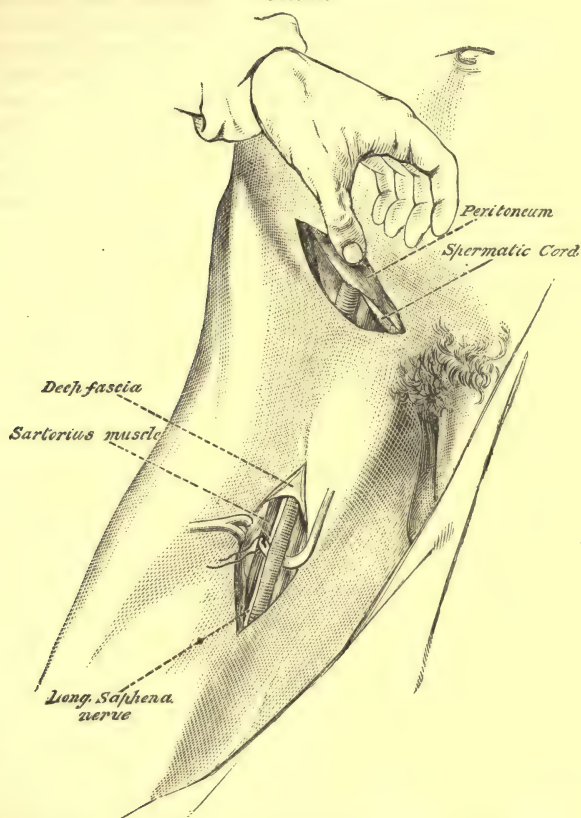
Ligature of the External Iliac Artery.—This operation may be required for aneurism of the common femoral, for wound, or for any other cause in which it is necessary to arrest the flow of blood through the lower extremity. It should not, however, be performed for any disease unless pressure of the artery, digital or instrumental, has proved ineffectual or is inapplicable, for Mapother ("Dub. Med. Press," 1865), Eck ("St. Barthol. Hosp. Rep.," 1866), and Hilton ("Med.-Chir. Trans.," 1869), have all recorded instances of cure of inguinal aneurism by these means. The operation of ligature is, however, a successful one; Norris and Cutter give forty-seven fatal cases out of 153 ("American Jour. Med. Sci.," 1847 and 1864). The course of the vessel is clearly indicated by a line drawn from the left side of the navel, where the aorta bifurcates, to the middle of Poupart's ligament, the upper third of this line corresponding to the common iliac, and the lower two-thirds to the external.

Abernethy was the first to ligature the vessel, in 1796, and the incision he adopted was a vertical one in the course of the artery, beginning an inch above Poupart's ligament. The peritoneum is, however, too much disturbed by this proceeding, and the abdominal walls weakened. The best incision is the one employed by Sir A. Cooper, a slightly curved one, about half an inch above Poupart's ligament, and to the inner side of its centre, curving upwards and outwards for about three inches towards the anterior superior spine of the ilium. This incision should divide all the soft parts superficial to the external oblique muscle. All vessels that are divided should be secured.

The tendon of the external oblique muscle should then be divided the whole length of the skin wound, with the internal oblique and transversalis muscles, when they cannot be drawn outwards, care being taken not to

injure the peritoneum, with the transversalis fascia that lies beneath; the cord which may now come into view should be drawn inwards, and the parts held well aside by hooked retractors. With the fingers the peritoneum is to be raised upwards, the transversalis fascia torn through from Poupart's ligament, and the sheath of the vessel exposed, the vein being to

FIG. 82.



the inner side of the artery; by means of a director and forceps the sheath can readily be opened and a ligature passed, the needle being introduced between the vein and artery. To divide the transversalis fascia the whole length of the wound is an unnecessary and dangerous proceeding; to leave it as suggested above is an extra protection to the peritoneum, and in no way renders the operation more difficult; indeed, I have been led to believe that it facilitates the operation; it certainly does upon the dead subject, and in the two cases in which I have been called upon to perform it on the living this opinion was confirmed. The genito-crural nerve, which lies upon the vessel, should not be included in the ligature. This operation is, however, only applicable for tumors situated below Poupart's ligament; for others, Abernethy's operation, or that suggested for the common iliac, should be chosen.

Ligature of the Common Iliac Artery has been performed about thirty-nine times, and ten times with success. It was first successfully performed

by Mott, of New York, in 1827. I have seen it done but once, by my colleague Mr. Cock, in 1863, on a man *æt.* 27, and with success.

To expose the vessel the incision must be a long one, its length being determined by the size of the aneurism, and depth of the artery. A curved one commencing outside the internal ring and passing upwards and outwards as for the external iliac artery appears to be the best, the muscles being divided to an equal extent. The transversalis fascia must be laid open or torn through, and the peritoneum turned upwards. It is at this part of the operation that the greatest difficulties arise, for as soon as the transversalis fascia is divided the peritoneum covering the intestine bulges into the wound. This membrane also is frequently adherent to the aneurismal sac, and much difficulty is felt in separating it. This was markedly so in Mr. Cock's case. The oozing of blood also into the wound masks the vessel. The depth of the wound, likewise, renders the application of the ligature a matter of great difficulty. Nevertheless, these difficulties are to be overcome by care and good aids. The operation is very similar to that last described, but more difficult. In 1846 Mr. Stanley ligatured the common iliac artery by an operation as suggested by Sir P. Crampton, and described by Skey. The patient was placed upon his side and an incision made from the end of the last rib downwards and forwards in front of the iliac crest. The transversalis fascia was divided, and the peritoneum rolled up. The common iliac artery was found and tied with apparent facility. Upon the dead body this operation is far from difficult and promises to be of use in the living when the aneurismal tumor is large and high up. Indeed it is probably the better operation of the two given. The abdominal aorta might be ligatured by the same means (*Fig. 74*).

Ligature of the Internal Iliac.—Stevens, of Vera Cruz, in 1812, was the first to perform this operation on a negress for aneurism of the nates. Since his time the operation has been repeated nine times, and in four cases with success. The incision and steps of the operation are the same as for the common iliac. Stevens, however, cut down through the anterior abdominal walls, as in Abernethy's operation for the external iliac. Ligature of the common iliac is probably the better operation.

In operating upon any of the iliac vessels the surgeon should remember that great variety exists as to their length, &c. When the common iliac is long, its branches will be short, and *vice versa*.

Ligature of the Femoral Artery.—This vessel may be tied in any part of its course, and when the thigh is straight a line drawn from the centre of Poupart's ligament to the centre of the popliteal space will mark out its position with tolerable accuracy. When abducted and rotated outwards a line drawn from the same point above to the inner edge of the patella will indicate the upper half of its course. In the upper third it is tolerably superficial; in the middle it is covered in by the sartorius muscle, which varies much in its width, and in the lower third it lies in Hunter's canal. At the present day it is an exceptional act to ligature the vessel in Hunter's canal; for popliteal aneurism, the artery is generally ligatured in the middle third of its course at the apex of Scarpa's triangle. For aneurism of the femoral itself the common femoral may be tied below Poupart's ligament.

The common femoral is usually about one inch and a half in length, but in one case in four it does not exceed one inch; in one in four it is between one inch and a half and two inches (Nunn). It is from these facts that surgeons have generally preferred to ligature the external iliac rather than the common femoral. The two Porters, however, and Macnamara, of Dublin, have brought forward sufficient evidence to prove that good suc-

cess may attend the practice, giving thirteen cases between them, eleven proving successful. On the other hand Erichsen tells us that out of twelve cases on record, three only succeeded, evidently having overlooked the Dublin cases. He gives it also as his opinion that the operation "ought to be banished from surgery." In this opinion I cannot agree, after a careful perusal of the Dublin cases in the "Dublin Quart. Journ.," 1860, and "Brit. Med. Journ.," Oct., 1867.

The operation is, moreover, a very simple one; the vessel being readily exposed by a vertical, oblique, or transverse (Porter's) incision. The sheath of the artery can be opened without touching the vein,—indeed the vein should never be exposed,—and a ligature passed, care being taken not to inclose the crural branch of the genito-crural nerve that runs down on the front of the vessel.

The main arguments against the operation are found in the uncertain length of the artery, the proximity of the ligature to large branches, and the liability to gangrene from the occlusion of the main nutrient arteries of the limb. On the other hand there is the success of the operation, and the facility with which it can be performed. The question, however, requires more experience before it can be decided. It should not be dismissed without due consideration.

Ligature of the Femoral Artery in the middle third of its course is a capital operation; it is, moreover, a successful one. Norris gives only 50 fatal cases out of 204 operations collected from all sources, ancient and modern, and undertaken under many different conditions. Syme tells us that he has had 23 successful cases in succession, and at Guy's Hospital during the last fourteen years the femoral artery has been tied for aneurism 24 times, with only 1 death (from pyæmia), and one failure. These cases include those in which pressure had been tried and had failed, and others in which pressure was inapplicable. Pressure had been employed in 17 cases, and in 11 with success; in 6 the artery was subsequently ligatured. Mr. Callender, of St. Bartholomew's, kindly reports that in the last ten years the femoral artery has been ligatured 15 times for popliteal aneurism, 3 cases proving fatal. To tie the vessel the limb of the patient should be slightly abducted and rotated outwards; the leg being partially flexed and the knee supported on a pillow. The line of the vessel should then be marked by the eye, and the point at which the ligature is to be applied determined, the lower part of Scarpa's triangle being the "point of selection." Fig. 82. An incision about three inches in length should then be made parallel to the vessel, dividing the integument and superficial fascia down to the deep parts; the course of the superficial veins having been previously ascertained by making pressure upon the saphena vein where it joins the deep femoral, in order to avoid it. Should the vein be in the way, the incision may be made by its side, but it is generally to the inner side of the wound. The deep fascia may next be divided, and the *inner* border of the main guide to the artery, the sartorius muscle, looked for. This is readily to be recognized by the course of its fibres *downwards* and *inwards*, and beneath this the sheath of the vessel is surely to be found. The muscle having been gently separated from its attachments by means of the finger, and held outwards with a retractor, the sheath will be exposed with the artery in front and vein behind, a nerve generally lying upon the vessel. The sheath must then be opened with caution, and its inner side held tense, an opening being made sufficient to expose the vessel and admit the aneurism needle; care should be taken to keep the end of the needle close to the artery, in order that the vein may not be injured or included in the ligature. The needle had better be passed from within

outwards. The ligature having been passed, the surgeon must satisfy himself that nothing but the artery is surrounded, and that the right vessel has been exposed; he may then tie it, readjust the parts, and close the wound, covering the limb with cotton-wool and raising it on a pillow. Should the vein be wounded by the needle the artery must not be tied at the point corresponding to the wound, but about an inch higher or lower, for "the thread would be left in the vein to act as a seton, and phlebitis could hardly fail to ensue, and would most likely prove fatal" (Holmes).

A ligature may separate from the femoral artery in nine or ten days, or may fail to do so for even thirty; a wide difference is found on this point, an analysis of cases fairly proving that no general rule can be laid down when its separation may be expected.

Ligature of the Popliteal Artery.—I hardly know under what circumstance the *popliteal artery* may require the application of a ligature; for a wound it may, perhaps, be required, but for rupture the operation is as inapplicable as it would be unsuccessful. Mr. Poland has pointed out how the posterior ligament of the knee-joint is frequently involved in the laceration of the vessel. For aneurism the operation is never likely to be required. Some years ago I was called upon to cut down upon a large needle that had perforated the popliteal space, and had become lost in its tissues; all movements of the joint having been rendered impossible by the pricking pain of its presence. I found the foreign body lying obliquely across the popliteal artery with its point fixed in the posterior ligament of the knee-joint. The artery was exposed without difficulty by an incision made along the outer edge of the semi-membranosus muscle, the leg being extended. The vein is always to be found to its outer side, and more superficial, the nerve is still further out.

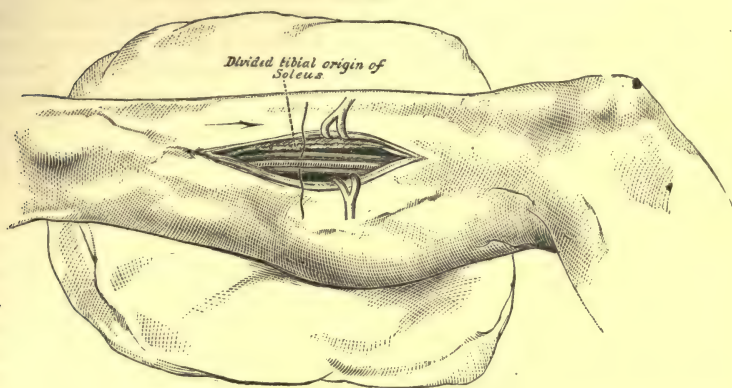
Ligature of the Posterior Tibial Artery.—Guthrie brought the weight of his great authority to support the recognized practice of tying a wounded vessel at the wounded part, even in the case of the deeply placed posterior tibial and peroneal arteries, and carried it out practically in a supposed wound of the latter vessel by making a free incision through the muscles of the calf of the leg down to the wounded artery. Arnott, also, acting on Guthrie's suggestion, tied the posterior tibial by this method, but neither the report of the case ("Med.-Chir. Trans.," vol. xxix), nor Mr. Arnott's remarks, are in any way encouraging in favor of its repetition; in fact, modern surgeons have universally rejected the method in favor of the one now to be described.

It must be premised that the vessel lies beneath the superficial layer of muscles forming the calf and beneath the deep fascia, the nerve being to its outer side; its course is indicated by a line drawn from the centre of the popliteal space to a point midway between the inner malleolus and the tendo Achillis.

To tie the artery the leg must be partially flexed upon the thigh and made to rest upon a pillow on its outer side, the heel being raised to relax the muscles. An incision about four inches in length is then to be made about half an inch from the edge of the tibia, and parallel with it, through the integument, down to the deep fascia, any large superficial veins being avoided where possible. The deep fascia may then be divided and the muscles exposed. The lower border of the tibial origin of the soleus muscle should then be looked for, and a director introduced beneath it, the tibial origin of this muscle being divided the whole extent of the wound. The glistening tendinous covering of the deep surface of the muscle is a good guide to the vessel, and it is not to be mistaken here for the deep fascia which lies deeper, and beneath which lies the vessel. To search for the

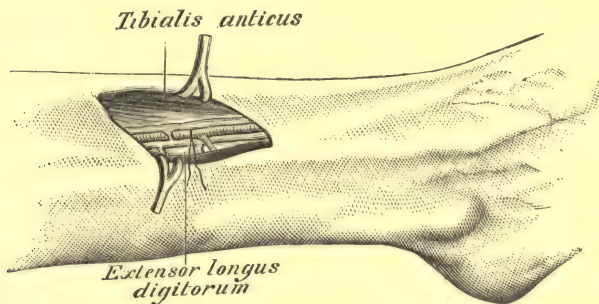
artery the leg may be well flexed, the heel drawn up, and the muscles retracted. The ligature may be passed in the most convenient way.

FIG. 83.



Upon the dead subject this operation is not a difficult one, and upon the living it can hardly be so "difficult, tedious, bloody, and dangerous" as Mr. Guthrie has described it, and as his own operation certainly is.

FIG. 84.



The operator, however, should be careful not to divide the tibial origin of the soleus too near the tibia, as he may in doing so get too deep beneath the deep fascia, and thus lose his best guide, the glistening tendinous tibial origin of the soleus.

To tie the artery at the *lower third of the leg behind the inner malleolus* is a simple operation. It lies with its venæ comites at the junction of the anterior with the middle third of the space between the malleolus and the heel, the nerve being behind. It can be readily exposed by a curved incision two inches long made in its course dividing integument, and deep fascia, which is thick from receiving many fibres from the internal lateral ligament. The relative position of the vessel is easily seen in the drawing.

Ligature of the Anterior Tibial Artery.—This operation is far from simple, as the vessel lies buried in the upper two-thirds of its course between the muscles on the interosseous membrane; its course is indicated by a line drawn from the inner side of the head of the fibula to the base of the great toe, and the surgical guide to the vessel is the tibialis anticus muscle, which lies to its inner side throughout its course.

To reach the vessel in the upper two-thirds of its course, it is consequently important to expose the intermuscular space separating this tibial muscle from its neighbors, and the best way to do this is to make an oblique incision four inches long, commencing at the outer edge of the tibia, and directed downwards and outwards towards the external malleolus, dividing the integument and superficial fascia. The deep fascia will then be exposed, and the first white line external to the tibia will be found to mark the intermuscular space outside the tibialis anticus muscle in which the

FIG. 85.

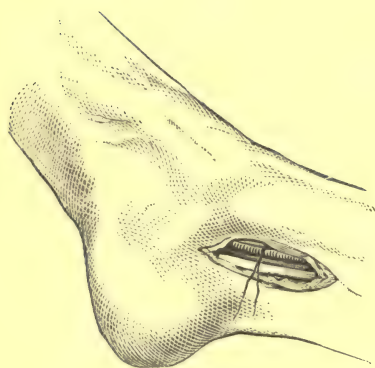
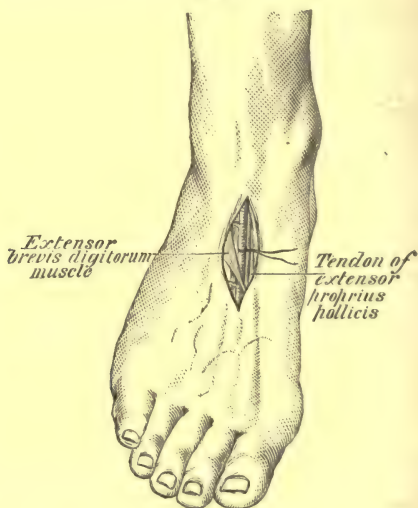


FIG. 86.



anterior tibial artery is to be found. The fascia over this line is then to be opened, and the muscles are to be separated, the foot being well flexed to facilitate this measure. The anterior tibial nerve will now come into view, and beneath this the artery will be found. The ligature may be passed as the surgeon best can.

The dorsalis pedis artery is to be ligatured to the outer side of the extensor proprius pollicis muscle, along which it lies. It is readily exposed by an incision made along its course, the integument and *deep* fascia being divided. The vessel is crossed at its lower part by the tendon of the extensor brevis digitorum muscle. The nerve lies outside the vessel, and venæ comites attend the artery. The tendon of the last named muscle is an infallible guide to the artery, as it crosses it, whilst the tendon of the extensor proprius pollicis muscle is the guide to the incision.

CHAPTER XXVII.

INJURIES AND DISEASES OF THE VEINS.

THE blood from a wounded vein is black, and flows in a steady stream, it never jets out as from an artery. When mixed with arterial blood, as occurs when both artery and vein are punctured, it may appear as a dark

band streaming through a red one, or *vice versâ*; the relative thickness of the black or red band indicating the extent of the wound in the artery and vein. Pressure on the distal side of the wound controls bleeding, whilst that on the cardiac side increases it.

Wounds of veins unite as do wounds of arteries, the same reparative process taking place in both; after a clean incision into a vein repair may be so perfect in a few days as to leave no trace behind. The lips of a vein wound readily unite when kept together by gentle pressure, as after venesection, or the application of a ligature.

A *completely divided vein contracts*, although less than an artery; it *retracts* also into its sheath, and the natural arrest of hemorrhage from a vein is helped by these actions, together with the coagulation of the blood in the vein and around its orifice. But these processes are slow in their action, very feeble, and practically insufficient. Happily, however, hemorrhage from a divided vein is readily arrested by well-adjusted pressure and the elevation of the limb. In amputations should venous bleeding persist after the removal of pressure from the limb above the wound, and the means just indicated have failed, the bleeding vein may be acupressed, ligatured, or, what is better, twisted, to stop it; bad results rarely taking place. When deep veins of large size are divided and cannot be treated a fatal result rapidly ensues.

A *partially divided vein* often gives much trouble, although not when *superficial*, for the elevation of the limb, and a compress carefully strapped or bandaged over the wounded part are generally sufficient to check the bleeding, and in three or four days repair may be expected, the pressure in no way interfering with this process.

Wounds of *deep veins* are, however, of grave importance, for they may be so placed that pressure cannot be applied, or bleeding may be so profuse as to cause speedy death; or, again, unhealthy inflammation of the vein may follow, with all its dangers.

In wounds of any of the veins of the extremities it is probable that well-applied pressure is, as a rule, sufficient to arrest bleeding, and give time for repair, although when the trunk of the femoral vein is wounded in operation, as in ligature of the femoral artery, it is a better practice to take up the opening in the vein with a pair of forceps and tie it with a fine silk ligature; and the same should be done with a punctured wound of the internal jugular, or any large vein. This practice is better than ligaturing the main trunk, as a whole; still it has its dangers, and amongst them phlebitis is the worst. This, however, is not very common. Wounded veins, indeed, may be treated on the same principles as wounded arteries; when pressure is enough to arrest hemorrhage from a vein, however large, the ligature is not required; when it fails, or is inapplicable, the ligature may be fearlessly employed. The dread of setting up phlebitis by interfering with the veins is based on prejudice and not on practice; it is doubtless due to the influence of the authority of great names who have pronounced against it. It is not, however, to be disputed that phlebitis occasionally follows the surgical treatment of veins, but it occurs as often as not independent of it. When it occurs it is a serious affection. It takes place, however, only in the enfeebled and cachectic.

Wounds of the *internal jugular and subclavian veins* are as fatal as wounds of the carotid or subclavian arteries, indeed probably more so. When the internal jugular is wounded near the base of the skull life is speedily destroyed, and when near its cardiac end, to the danger of hemorrhage is added that from the introduction of air into the heart. When the internal jugular is divided above the clavicle, the orifice remains open;

the walls of the vein do not collapse, as they would at a greater distance, owing to their connections with the deep cervical fascia; reflux bleeding consequently takes place from the cardiac end, and during some violent inspiratory act air may be drawn into the circulation and into the heart, causing death. Thus great care is always required in operating about the root of the neck to avoid great veins, and to compress or ligature them when wounded.

When death takes place from primary hemorrhage from the internal jugular it is generally within the hour. I recorded such a case in the "Trans. of Path. Soc." in 1857 that occurred in the practice of Mr. Birkett. Mr. Henry Gray recorded a second in "Holmes's Surgery," and Mr. Samuel Cooper a third in his "First Lines of Surgery."

When death does not take place from either of the above two causes it may occur from secondary hemorrhage or from pyæmia.

Coagulation in Veins.—Adhesive Phlebitis. When a vein was found by the older surgeons obstructed by a fibrinous clot, the suspicion of phlebitis was excited, and when this clot contained in its centre a "puriform" fluid, the evidence of inflammatory action was considered to be strong. When the clot was more or less adherent to the inner membrane of the vein, and this membrane presented a pink appearance, the evidence was thought to be complete. At the present day, however, none of these observations are accepted as true indications of an inflamed vein; for it is known that blood coagulates spontaneously in a wounded, lacerated, or bruised vein, from prolonged pressure upon its walls or inflammatory changes in the parts around, and that even in ill-nourished and cachectic subjects there is a remarkable tendency for the fibrin of the blood to become deposited upon the serous lining of the veins, either idopathically, from some altered condition of the blood, or upon the slightest injury, without the existence of inflammatory action.

The supposed pus found in the centre of the fibrinous mass is known to be made up of the white blood-corpuscles present in all coagula, and the pinkish tint upon the serous lining of the vein is due to the mere imbibition of coloring matter from the blood, and not from inflammatory injection.

A clot once formed in a vein rapidly increases, the stream of blood as it flows over it depositing fresh layers, until the whole calibre of the vein is obstructed; when the process is slow regular layers of fibrin may be seen in section, when rapid the clotting is irregular. At the extremities of the clot, also like accretions are deposited; the coagula, increasing more or less rapidly in all directions, and into all branches, till complete obstruction, or THROMBOSIS, takes place. This clotting of blood in the vein becomes arrested only by the blood stream of a junction trunk. These coagula can readily be removed by washing, and when removed the lining membrane of the vein will generally be found natural, and the valves visible. The coat of the veins at times may appear thickened from contraction, but Mr. Callender has shown this condition is not real but only apparent, the coats of the veins readily yielding to pressure under water. In the process of cure sometimes the clot will contract towards one side of the vein, and thus allow the blood to pass and the circulation to become re-established. In rarer cases the blood "may drill for itself a passage through the centre of the clot." More commonly, however, a different result takes place, the vein becomes permanently obliterated, the clot and vein ultimately contracting so as to form a firm and shrunken cord. In rare cases the clot may subsequently organize. Authors have described these cases as instances of *adhesive phlebitis*. In feeble and cachectic subjects, however,

these curative changes will not take place. The clot instead of organizing will soften and disintegrate, giving place to blood-stained puriform fluid, that may be carried into the circulation through the heart into the lungs, and set up a lobular pneumonia, such as is found in pyæmia from embolism of the pulmonary artery. This was well illustrated in the following case, extracted from the catalogue of the Guy's Museum, No. 1521⁵⁵. Jugular vein exhibiting a wound occupying about half its circumference, and situated about half an inch above the subclavian, the neighboring branches showing the effects of phlebitis. James F—, æt. 30, under Mr. Birkett. He received a stab with a knife in the left side of the neck by which the jugular vein was wounded; Much hemorrhage followed, and continued for some days, when symptoms of phlebitis set in, and he died of pneumonia twenty days after the accident. The vein was found wounded as seen in the preparation, its coats infiltrated with lymph, and its interior filled with fibrin. The lungs were filled with abscesses.

Results such as these do not, however, occur under all circumstances, they do so only in the feeble and cachectic, for "the clot when softened is usually shut off in an upward and downward direction by newly added coagula. The softening begins in the coagula last formed, and not as Virchow states, in those first deposited, for in the advance of the malady the patient's health fails, and the fibrin becomes more and more prone to disintegrate and soften into a puriform fluid" (Callender). The clot, moreover, softens in the centre and not at its periphery. These cases have been described as examples of *suppurative phlebitis*.

Symptoms.—The most prominent symptom of an obstructed vein is œdema of the parts below the obstruction, some fulness of the superficial veins, local pain and tenderness, with constitutional disturbance of variable degrees of severity generally preceding. When superficial veins are involved the symptoms may be chiefly local; when the deep veins, constitutional disturbance is sure to accompany local action. Amongst the superficial veins the saphena of the leg and thigh is most commonly affected, and it is often a sequela of a varicose condition. Under these circumstances the tortuous dilated indurated vein becomes a marked object, set as it were in a frame of indurated inflamed skin and cellular tissue. The parts themselves will to a certainty be painful, and the pain and tenderness will probably extend up the thigh as far as the groin. Amongst the deep veins the common femoral or iliac is more frequently involved than any other, and what is called a "white leg" is due to this affection; this "white leg" being an œdema of the leg from an obstruction to the femoral or iliac vein, and it is usually the first symptom that attracts attention. Local pain and tenderness will always accompany it, and more or less constitutional disturbance. In some cases it is of a very mild character, and in these a good result may be anticipated; in others it is most severe, and in such suppurative changes will probably take place.

It sometimes happens that a limb will become much enlarged in the deeper parts but not in the superficial, that is, no œdema of the cellular tissue beneath the skin will be present, although the superficial veins will be turgid. The absence of this general symptom must not, however, mislead; it simply indicates that the superficial circulation is efficiently carried on, and that no stagnation exists sufficient to allow of passive serous exudation taking place.

When these cases go on favorably the swelling will gradually subside, with every other symptom, and the circulation of the part become restored, the vein either recovering its normal condition, or the blood finding its way through other channels. When they go on unfavorably suppuration will

take place, and when the deep parts are involved the case assumes a very serious aspect. A local or a diffused abscess may result, the latter condition being the more common one, and then too frequently blood-poisoning ensues, with its usual consequences.

TREATMENT.—The two great indications for treatment of these cases are (1) *to favor the venous circulation of the part, and* (2) *to maintain the general condition of the patient.*

The first is to be attained by elevation of the limb, the foot being raised higher than the hip, and the application of warmth to the part in the shape of fomentations or cotton-wool.

The second is to be carried out by the administration of a simple nutritious diet, tonics, as quinine, bark or iron, and stimulants carefully adjusted to the wants of the individual case.

Pain must be allayed by local and general means, such as poppy fomentations, and the internal use of opium, morphia, or chloral.

Leeching should never be employed, nor mercury in any of its forms; such practice was based on a mistaken pathology, and should be discarded.

When suppuration appears it must be dealt with on ordinary principles; it being wise as a rule to evacuate pus as soon as its presence has declared itself.

There is, however, another form of phlebitis that must be mentioned, and it is by far the most serious. The *unhealthy diffuse or suppurative phlebitis*. It is an affection of the cellular tissue around the veins, the veins themselves being secondarily involved. It is a kind of erysipelatous inflammation of a low type, and it is only found in the feeble and cachectic. It may be after a severe injury to, or operation on, bone, or otherwise; after a slight contusion or a severe wound; it may follow the puncture, division, or ligation of a vein, or chronic suppurative disease, more particularly of the bones of the cranium. It occurs also in the puerperal state. Depending upon a vitiated condition of the blood, "we are able to appreciate how it is that the many different forms of phlebitis may follow various dissimilar injuries, and reconcile the infrequency of their occurrence after operations involving the venous system. The dangers are not to be looked for when the general condition of the system of the individual is good, and when the walls of the vessels are in a healthy state, but they may be anticipated in enfeebled and broken-down constitutions, more particularly when the coats of the vessels are abnormally changed. Upon such a class of persons operative procedures should, therefore, if possible, be avoided." Dr. S. W. Gross, 1867.

The disease shows itself as a purulent infiltration of the cellular tissue surrounding the vein, with a thickening and softening of the coats of the vein itself. As the disease progresses abscesses form around the vein, whilst the circulation through it is arrested by the formation of coagula in one spot, and a sloughing abscess in another. In superficial veins, such as in the leg, all these changes can be well seen; in the deep they are difficult to diagnose. In the superficial the external signs of inflammation will be well marked, local redness and brawniness of skin, around a dilated, thickened, and tortuous vein being the chief symptoms. As the disease progresses, local abscesses will appear in the vein itself, and on being opened blood and pus will escape; the contents being, doubtless, broken-down coagula.

The constitutional symptoms will vary with the extent and severity of the disease; marked depression of the general powers will always be present, and rigors will not only usher in the attack, but attend its progress; each one probably indicating some suppurative change. Local pain and sleep-

lessness are common accompaniments, and in cases that cease to be local and have an infective tendency, what are called typhoid symptoms occur. When blood-poisoning or pyæmia appears, the symptoms will be such as have been described in an early chapter.

On the Presence of Air in Veins.—That air may find its way to the heart through an open vein, and cause sudden death, is a clinical fact that all surgeons should be familiar with; and that it generally arises during the removal of tumors about the neck and axilla, amputations at the shoulder joint, and operations or wounds involving the cervical or other veins, is fairly proved by statistics. It has likewise occurred in uterine surgery from the injection of air or gas, &c. Two-thirds of the patients affected die from the accident, half within a few minutes, others living hours or a few days. The accident is favored by a thickened state of the vein. It is generally indicated during the progress of an operation by a sudden gurgling, hissing, or bubbling sound in the wound, associated with venous bleeding, sudden faintness, and insensibility of the patient, or convulsions, probably terminating in death. When this result does not at once take place, there will be labored and irregular respiration, tumultuous action of the heart and feeble pulse, the lividity of the patient gradually disappearing; the heart may then regain its natural action, and the patient recover. Bubbles of air may at times be seen in the wound. In some cases the patient will give a sudden cry with the first onset of the symptoms.

After death evidence of the admixture of air with the blood has been found, bubbles existing in the vessels of the brain, large venous trunks and arteries. In some cases air has been found in the right cavities of the heart. Where a suspicion of this cause of death exists, the heart and large vessels should be opened under water to make manifest the escape of air-bubbles—one single bubble indicates air in the heart, many bubbles air in the vessels. Experiments on animals by Erichsen and others by a French commission tend to confirm this observation.

TREATMENT.—How to deal with these cases is the next point to be considered; and without doubt preventive measures are more important than curative. The surgeon in dealing with large veins, or indeed any veins near their cardiac ends, should be careful to apply pressure upon them, and to maintain it during the operation; in some instances it is more expedient to ligature before dividing or twisting them. When the bubbling sound has been heard, pressure must be at once applied to the spot where the bubbles appear. When a large vein has been wounded by accident, and its division is not required, the opening must be taken up by forceps and carefully closed with a fine silk ligature. Let the surgeon always avoid large veins when he can.

When air has been admitted into the heart, and its action interfered with, the surgeon's aim must be to keep up its action, and help the respiratory act by artificial means; cold water on the face and thorax, stimulants, as ammonia to the nostril, &c. Amussat ascribed recovery in one of his cases to pressure upon the chest, leaving the opening in the vein free to allow of the escape of the admitted air. In adopting this practice care must be observed to close the orifice of the vein in the inspiratory act. Brandy and diffusible stimulants must also be freely given to sustain and stimulate the vital organs.¹

Hypertrophy and Atrophy of Veins occur in precisely similar circum-

¹ The reader may refer to an admirable paper on this subject, by Dr. J. S. Green, of Massachusetts, "*Amer. Med. Journ.*," 1864.

stances as hypertrophy and atrophy of other structures. Thus where increase of function of a part exists or increased growth, the veins will elongate, dilate, and thicken. When decrease of function or disease of a part takes place, the veins waste or become atrophied with other structures. Thus after amputation of the

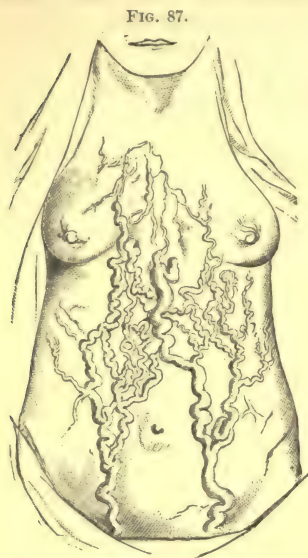


FIG. 87.

Taken from a woman æt. 47, under the care of Sir W. W. Gull, Bart., in whom the vena cava was completely obstructed from cancer. Guy's Hosp. Mus., drawing 44th.

There was no evidence of less free circulation.

extremities all through the case, proving the perfection of the compensatory venous collateral circulation, and probably indicating the gradual progress of the obstruction.

Calcareous and Atheromatous Diseases of the Coats of Veins may occur, but they are rare affections when compared with their frequency in the arteries. In the Guy's Museum 1538th there is a good specimen of ossified saphena vein, and at St. Thomas's Hospital, and the College of Surgeons may be found examples of calcareous degeneration of other veins. Gay has also described a dissection of a varix which "appears to have been occasioned by disease originally atheromatous, followed by softening and ulceration of the inner and middle tunics of the vessel;" and Mr. Pick, of St. George's Hospital ("Path. Trans.," 1867), has given a somewhat similar example. How far, however, this atheromatous and calcareous degeneration is a distinct disease, or an "after change in some local deposit of fibrin" is an open question.

Varix: Varicose Disease of the Veins and Phlebolites.—The term varicose vein is an unfortunate one, as it is applied to any enlarged tortuous vessel, to such as have been already described as hypertrophied veins, and to others that are clearly due to some diseased action resulting in hypertrophy with dilatation. In the present page the term will be confined to the latter condition. Varix is commonly an affection of the veins in the lower extremities and mainly of the branches of the saphena vein; when

thigh the femoral vein becomes as small as the anterior tibial, and in the case of arterial varix, related in a former chapter, the vein above the varix withered to a mere cord. In both cases the vessel had been rendered functionless. On the other hand, in the same case of arterial varix described in page 193, the popliteal vein below the varix when taking on the action of an artery became much enlarged and thickened, in fact hypertrophied, simply on account of the increase of work it had to perform under its new condition; and the superficial cutaneous veins through which the whole of the returning blood must have passed were enormously enlarged. An equally good instance of hypertrophy of veins is seen when any obstruction occurs to one of the cavæ or any large venous trunk, the venous circulation making its way through other channels, which consequently enlarge. Thus, in Fig. 87, the skin veins of the abdomen and chest are seen to be enormously distended and hypertrophied, to carry on the circulation from the lower part of the body to the heart; the lower vena cava having been completely obstructed from cancerous disease. The woman, æt. 47, a patient of Sir W. W. Gull, had no œdema of the lower

it involves the submucous veins of the rectum it is called a hæmorrhoid, when of the spermatic vein a varicocele. But "all the veins of the body may become varicose," said M. Briquet in 1824. In 1869, a child *æt.* 4, was brought to me with a sacculated varix the size of a nut connected with a vein on the outer side of the right forearm; it had been coming on for a year and a half. Taking varix of the lower extremity as a type of the affection, it appears as a disease involving one or more, and in extreme cases all, of the branches of the saphena vein. In most instances it is confined to the larger trunks, and rarely spreads to the smaller tributaries.

In some, however, the affection appears to begin in the capillaries of the skin, and spread towards the larger trunks, and such cases are most common in women. They appear as "clusters of diseased venous radicles" (Gay) and rarely involve other than the smaller branches.

It must not be thought, however, that this affection is one of the superficial veins alone, for such is not the case. Boyer, many years ago, said it was, and upon his authority the opinion has been accepted. Verneuil corrected the error, and in the "*Gazettes Hebdomadaire et Médicale*," 1855, showed that varix is as often a disease of the deep veins as of the subcutaneous, the latter often indicating the existence of the former; he believed, moreover, that the intramuscular veins are sometimes affected without the subcutaneous. More recently Callender has told us that the varix of a subcutaneous vein is found wherever the intramuscular veins pass into the subcutaneous, stating that "the valves obstruct below, and the column of obstructed, slow-moving blood resists above." He has failed, however, to confirm Verneuil's remark that varix of the intramuscular branches is constant.

Mr. Gay, a recent author on varicose veins (1868), says, after many dissections, that "with superficial varicosity there are other serious lesions affecting both arteries and veins, deep and superficial, such as would lead to the conclusion that the general circulation has been subject to very considerable and long-standing embarrassment, some incompetency of the arterial system or impediment to the venous, or both combined;" and these conclusions are probably right.

The causes of varicose disease of the veins are obscure. The surgeons of old were in the habit of looking upon such affections as the invariable result of some obstruction to the venous circulation, such as prolonged standing, the presence of abdominal or pelvic tumors—pathological, fecal, or foetal; patients of a relaxed and feeble habit naturally suffering more than the robust; and, in a measure, there can be little doubt that their opinions were correct. Mr. Herapath, of Bristol, used to maintain that the cause of varix was the narrowing of the saphenous opening of the thigh, and cases are on record where its enlargement proved of value; we want, however, facts to support this view. General testimony also admits that this disease is as common in the higher ranks of life as in the lower; that it is as common in women as in men; that it is as frequent on the right side as the left, and more frequently is found on both sides; that it is a disease of the young as much as of the middle aged; that it is found in the strong and healthy as in the feeble and cachectic; in fact, that it is found under every condition of life, and in every variety of subject. Some evidence exists that gout and hereditary predisposition are efficient causes, with local injuries and prolonged muscular exertion.

The symptoms of this affection vary according to the place of its origin. When it commences in the venous capillaries—its common seat in women—it appears as a fine capillary injection, giving an arborescent appearance to the skin, with more or less congestion; and as it extends, the

larger venous trunks become involved, the main trunks in these cases being rarely affected.

When it originates in a large trunk the varix may appear as a fusiform enlargement, or a simple dilatation of the whole length of the vein. In some cases there will be thinning of the venous coats, in others a thickening, whilst in a third class one part will appear thin and another thick.

In some cases the affected vein becomes tortuous and knotted to an extreme degree, it being far from unusual to find it the diameter of a finger (Fig. 88). The valves of the veins under these circumstances are clearly lost, not however from a yielding due to backward pressure of the column, but from their action being rendered imperfect by the dilatation of the vein behind; the "valve cusps being unable to meet and close the canal shrink and atrophy."



FIG. 88.
From wax model.
No. 1.

As the disease progresses the tissues around the affected vein are gradually absorbed; the skin becoming thinned and the bone even grooved; the skin may indeed become so thin as even to rupture, and a fatal hemorrhage is far from being a rare result. At Guy's during the last few years several cases of the kind have taken place. At times subcutaneous rupture of the vein may occur. In 1858 I saw a severe example of this in a man *æt.* 62. More frequently, however, the soft parts around the diseased vein thicken or inflame. They thicken from a kind of passive exudation into the cellular tissue, the result of impeded venous circulation, and give rise to a slightly anasarous condition of the part, which in chronic cases becomes somewhat permanent, producing what Liston so well described as a "solid oedema." In extreme instances this solid oedema is so marked as to give rise to appearances similar to the disease called "elephas," or Arabian elephantiasis.

On the other hand, it is a very common result for the cellular tissue around the vein, and probably the vein itself, to inflame. The parts around the varix or tortuous vein become indurated, red, and painful. In healthy subjects this inflammation may end as an adhesive one (local adhesive phlebitis), and in the feeble as a suppurative one; local or diffused abscesses, subsequently showing themselves. When the powers of the patient are very low, or blood-poisoning takes place, that terrible disease, unhealthy suppurative phlebitis, as previously described, may ensue.

In the early period of the disease an aching of the limbs on standing, or after exercise, may be the only symptom, a local pain at times indicating the seat. In a more advanced period oedema about the ankle may be observed.

When the femoral vein at the saphenous opening—where the grand venous junction takes place—becomes dilated, the swelling may on a careless examination be mistaken for a *femoral hernia*, for both will disappear on the patient assuming the recumbent posture, and reappear on his coughing; there is, however, this point of distinction, that by local pressure on the crural ring a femoral hernia can be kept in its position, when a femoral varix will readily be made to enlarge.

As a secondary result of varicose disease the blood in the vein may coagulate, and give rise to *thrombosis*, and this coagulum may break up, causing a local abscess, or wither and organize, causing occlusion of the vein and consequently a partial cure. There is reason also to believe that this may dry up, and become so altered as to form what are known as *phlebolithes*, for these have a laminated character, and in Dr. Franklin's analysis

are composed of protein matter and phosphate of lime, with a little sulphate of potash and lime.

With varicose disease of the veins there is very frequently associated an eczematous condition of the leg, the eczema being apparently due to the feeble venous circulation of the part; if this eczema be neglected a superficial ulceration of the skin may ensue, and if no attention be paid to this condition the ulcer will become chronic. But beyond this no special form of ulcer can be said to exist as a result of varicose veins, in fact there is no such thing as a "varicose ulcer." Every variety of ulcer is found in practice associated with varicose disease, and the existence of the latter doubtless renders the repair of the former somewhat more difficult. Thus it is that chronic indolent sores associated with varicose diseases have been called varicose ulcers.

TREATMENT.—Varicose disease of the veins in its early stage is very amenable to treatment, but later on nothing can be more obstinate; the patient may be relieved, but rarely cured. Happily, however, it is not a disease that threatens life under common care.

When the affection is first discovered the local treatment must be directed to assist the venous circulation by the raised position of the limb, the patient being recumbent; friction should be steadily applied upwards; all sitting, standing, or walking should be strictly prohibited; and when possible this treatment should be persevered in for three or four weeks. When exercise is allowed steady pressure by a well-applied bandage from below upwards should be maintained, or an elastic stocking worn, and in the course of time, varying vastly, a cure may be effected and maintained.

During this time the general treatment must not be neglected. Where the powers are feeble, tonics must be given, and of these iron is the best; twenty drops of the tincture of the perchloride with ten of the tincture of nux vomica being a capital compound.

A generous diet must be given when indicated, and the reverse where the portal system has been overgorged by excess. Mild aperients are always of value under these circumstances, salines being preferable to the purgative extracts. The natural waters are of great value in these cases.

When rest cannot be given, well-applied pressure must be relied upon, a pad of cotton-wool over the part and a bandage of Dommett's or elastic tissue well put on from the toes upwards being the best substitutes, or good strapping well applied may be used. The patient must be impressed, however, with the necessity of assuming the horizontal position as much as he can; aiding the circulation by friction as already indicated, and by general treatment. The bandage should always be put on before the legs are moved off the bed, and removed only after the recumbent position is again resumed.

In bad cases of local varix the pressure may be more local and permanent; a pad of cotton-wool well fixed on by strapping being very valuable. When the veins are inflamed they must be treated on principles already laid down in the chapter on phlebitis.

Should a vein burst bleeding is readily controlled by the application of a finger to the spot, and any further flow is prevented by the elevation of the limb. A pad carefully adjusted to the bleeding point and fixed by strapping applied like a bandage or a roller, making the patient safe.

Operations for Varicose Disease of the Veins.—It has been observed that nature not infrequently obliterates a varicose vein by means of a coagulum, which subsequently contracts and even organizes, the clot and vein together turning into an impervious cord. Acting upon this knowledge surgeons now try to make use of nature's processes, and by artificial means to induce

coagulation of the blood in some portion of the varicose vessel, with the hope that it may contract; or so to destroy some part of the vein itself as to compel the circulation to find another course. In fact, the surgeon's aim is to obliterate the vein—this is the so-called radical cure—but it is to be thought of only, as Mr. Gay so truly says, when the vein is hopelessly deteriorated, or as is so frequently the case, it is inflamed and painful, and threatens to burst; it should be entertained only in cases in which all palliative and other treatment is inapplicable or has failed.

Caustics were employed by Mayo for this purpose, as well as by Brodie, Key, and others. They should be thus applied: A small piece of Vienna paste (composed of four parts of potassa fusa and four of quicklime, made into a paste with spirits of wine prior to its application), or chloride of zinc paste of the size of a small pea should be applied upon the vein, the surrounding skin being previously protected by a ring of plaster carefully adjusted; the paste should be fixed on and left, the object being to cause a slough through the tissues into the vein. This slough should not be large, but three, four, or more applications may be simultaneously made about an inch apart to guarantee success. The caustic may be left for twelve or twenty-four hours and then removed, the part being dressed with water-dressing. During this treatment the patient must be kept in bed with the limb raised.

Subcutaneous Division of the vein was practiced by Brodie, but after some experience he came to the conclusion that "it really appears it is not worth patients' while to submit to it."

Excision of a portion of the diseased vein has likewise been employed, but with no good success.

The best operation is, doubtless, that of *acupressure*, performed by passing a pin beneath the vein, but not through it as in Davat's plan, and obstructing the circulation through the vein by means of a twisted suture applied round the pin, either of silk, india-rubber or wire, or a piece of thin india-rubber stretched across it on the pin, as suggested by Mr. Lee. Two or even six of these acupressure needles may be inserted about an inch or an inch and a half apart, according to the extent of the disease. Mr. Lee employs also the subcutaneous division of the vein between the pins at the same time, and my own experience would confirm the wisdom of this practice. Wood employs an elastic steel spring to keep up tension on the ligature till it cuts its way through.

On several occasions, having obstructed the circulation through the vein as described above, I have injected the vein between the pins with perchloride of iron, one drop being generally enough to cause coagulation of the blood; in others I have used a concentrated solution of tannin; in all a good result ensued; and I am disposed to regard this practice as being preferable to any other. The syringe employed should be that used for hypodermic injections.

The time for withdrawal of the pins must vary according to the effect intended to be produced; when inserted to induce coagulation of the blood only, and not inflammation, they may be withdrawn on the third or fourth day, and in the practice suggested of acupressure and injection this plan should be followed. When inflammation is required they must be left for many more. Sir W. Fergusson states, "they should be left until they have excited considerable swelling and slight ulceration, and in some instances, when the former is not very conspicuous, they may be permitted to separate by ulceration through both vein and skin. I recommend that the process of inflammation should be more implicitly relied upon than that of coagulation;" he adds, moreover, that he has not met with any seriously un-

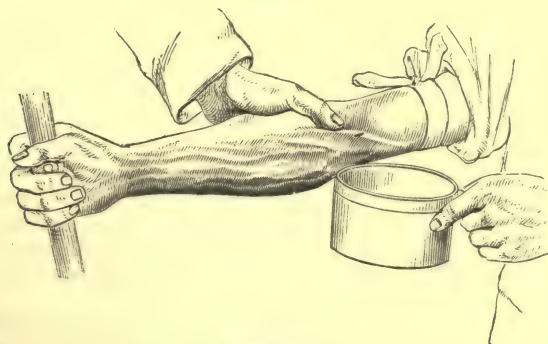
pleasant effects out of the numerous instances in which it has been employed.

It must be repeated, however, that none of these operations should be performed where palliative treatment is applicable; they should be practiced only in extreme cases. When a vein threatens to burst, or has burst and endangered life, surgical interference is very good.

Mr. Gay has lately called attention ("Lond. Med. Soc.," Oct., 1871) to a class of cases in which the superficial or complementary veins, as he calls them, are obliterated, and, as a result, the return of the venous blood is carried on entirely by the deep veins; these consequently become diseased, the circulation through them becomes feeble, and degeneration of the tissues ensues, associated with deep-seated solid œdema of the limb, not subcutaneous œdema, which belongs to obstruction only in the subcutaneous veins. For this disorder exercise, warm applications, tonics, &c., are called for; bandages and rest do harm.

Venesection.—At the present period this operation is a very rare one indeed; at Guy's Hospital it is as rare, if not more rare, than amputation. Forty years ago it was one of the commonest, and there seems some reason to believe that it will soon be practiced again with greater frequency. It is not a difficult operation, but it requires nicety and care. It is usually performed at the bend of the elbow. The first thing the surgeon has to do is to render the veins prominent by arresting the circulation through them by means of a piece of broad tape or narrow bandage carried twice round the arm a few inches above the elbow, and tied in a bow, but not tight enough to stop pulsation in the arteries (Fig. 89). He then selects the

FIG. 89.



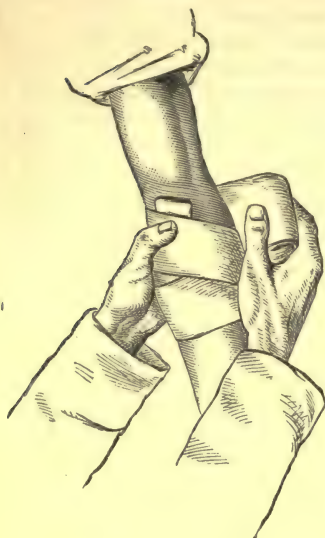
From Heath.

vein, the largest being the best. Where the outer vein, or median cephalic, is of good size it should be chosen, the inner or median basilic, lying immediately over the brachial artery, but either may be selected, care being observed not to go *through* the vein. The surgeon should also assure himself that no malposition of the artery exists, for many cases are on record where a superficial artery has been opened for a vein.

The vessel having been selected, the surgeon should stand in front of the extended arm and hold it with his left hand, the thumb being fixed on the vein below the spot which is to be opened. With his right hand an oblique incision, not a puncture, is then to be made through the skin into the vein, describing with the lancet a semicircular movement. The bleeding-basin having been brought close to the arm, the surgeon's left thumb

may be removed, the stream of blood being allowed to escape. Should this be feeble, the patient may be made to grasp a stick and put the muscles of the forearm well into action.

FIG. 90.



From Heath.

The required amount of blood having been withdrawn, the tape is to be removed, the left thumb of the operator being applied to the wound and the parts cleansed. A pad of lint is then to be placed over the wound, its edges being kept well in contact, the thumb being slipped downwards to allow of its adjustment, and this is to be fixed by a figure-of-8 bandage (Fig. 90). The arm should be slightly bent, care being taken that the pad does not slip during this process.

On the second or third day the pad may be removed, the wound having probably healed by this time.

Opening the external jugular vein is sometimes called for, particularly when venesection is required in a child, and that part of the vein should always be selected where it passes over the sterno-mastoid muscle. The vein is to be steadied and rendered prominent by the left thumb of the surgeon applied at the root of the neck above the clavicle, or this may be done by means of a pad. The vein is then

to be opened with the lancet by an incision made in the course of the sterno-mastoid muscle, and consequently across the platysma. Blood will then freely flow; when enough has been taken the wound is to be closed by means of a pad carefully adjusted, and the thumb, which has been acting as a compress, removed. This pad had better be fixed by good strapping.

In both these operations of venesection, if the wound in the skin be made smaller than that in the vein, or the position of the arm be changed, a blood tumor or thrombus may form from the escape of blood beneath the integument; and should this interfere with the flow of blood, instead of reintroducing the lancet, the best practice is to untie the arm and apply a pad to the wound, opening a vein in the other arm.

In fat subjects there is occasionally some difficulty in finding a vein. Friction of the surface of the forearm will at times help the surgeon, or the application of a hot flannel round the arm, which should be made to hang down by the side of the body. When these means fail and venesection is imperative, a vein of the foot may be opened.

In operating on the jugular vein great care must be taken not to admit air into the vein by the removal of the thumb during the operation till the pad has been adjusted, otherwise life may be endangered.

Gross, Dr. S. W., "American Journal of Medical Science," 1867.—Callender, "Holmes's System of Surgery," 2d ed., 1870.—Travers, "Surgical Essays," 1818.—Langenbeck, of Berlin, "Archiv fur Klinische Chir" 1860.—Armott, "Med.-Chir. Trans.," vol xv, 1829.—Lee, Henry, "Disease of Veins," 1866.—Greene, James S., Dorchester, Mass., "American Journ. of Med. Science," 1864.—Gay, "Varicose Diseases of Leg," 1868.

THE SURGERY OF THE DIGESTIVE SYSTEM.

CHAPTER XXVIII.

AFFECTIONS OF THE LIPS, MOUTH, ETC.

Wounds of the Lip should always be brought together by sutures, which, if any gaping exists, should be deeply inserted, for less deformity is likely to follow this practice than when the parts are left to granulate. Under all circumstances the wound should be well cleansed and all foreign bodies removed. Superficial wounds in the inside from the teeth may be left to granulate. When much bleeding exists the surgeon should examine the part with care. Erichsen gives a case in which so much blood was lost from the coronary artery, swallowed and brought up again by vomiting, as to lead to the suspicion of some internal injury. Sutures in the lip may almost always be removed on the second or third day. Plasters are, as a rule, not required.

Congenital Fissures of the Lips.—These more frequently occur as harelip than in any other form. Sir W. Fergusson has, however, quoted three cases in his "Practical Surgery," in which the fissure extended from the angle of the mouth, to the malar bone in one case, in the second towards the angle of the jaw, and in the third to the base of the lower jaw. The treatment of these cases would be as for harelip.

Harelip.—This congenital deformity is due to a want of union between the natural centres of development of the upper lip. Thus, the upper lip is made up of a central and two lateral portions, the central being connected with the intermaxillary bones, and the lateral with the superior maxillary (Fig. 91). A want of union between the lateral and central piece on one side gives rise to simple harelip; a want of union between the central and both lateral pieces to double harelip. These fissures may be partial or complete; they may involve the skin only or the bone also, and the latter in variable degrees. It can never be in the median line.

I have seen in the lip of an adult (Fig. 92) a congenital cicatrix on the left side of the upper lip with a slight elevation of its mucous margin, which may be said to be the very earliest indication of a harelip, and the child of this woman had a complete fissure. In more complicated cases the cleft will extend

FIG. 91.



Showing the development of the intermaxillary and maxillary bones. From Fergusson.

FIG. 92.



FIG. 93.



FIG. 94.

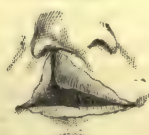
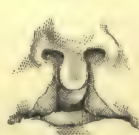


FIG. 95.



through the alveolar process, in a line corresponding with the labial fissure; in others it will involve the hard palate; in a still worse class both hard and soft palate will be fissured.

In a small percentage of the cases, about a tenth, the harelip will be double. In these it is not uncommon to find a double fissure extending through the palate; the two superior maxillæ with the skin having failed to unite with the intermaxillary bone. Under these circumstances the

FIG. 96.



intermaxillary bone will often project forwards, covered with a small flap of skin, at times even standing out from the tip of the nose. In a rare case (Fig. 96) the fissure involved the lip and intermaxillary bones alone, the maxillæ being complete.

These points are well illustrated in the annexed drawings, which have been taken from patients to show the different degrees of the deformity.

This affection is more frequently on the left side of the mouth than on the right. It is more common in males than females, and in the more complicated examples this fact becomes very striking. Thus, in an analysis of cases to be found in my "Lectures on the Surgical Diseases of Children," 1863, four-fifths of the bad cases were in boys; cases of double harelip are almost always found in the male sex.

TREATMENT.—When ought a child with harelip to be operated upon? Sir W. Fergusson says, "I am of opinion that the earlier the operation is performed the better—assuredly before teething;" and the majority of surgeons would support this opinion. Judging from my own material I am not disposed to coincide altogether with this view, for in my analysis of cases at Guy's Hospital a larger number of failures followed the operation when performed during the first few weeks of life than after the third month. In healthy infants it is probable that success will attend the operation whenever undertaken; but in the more feeble it is also probable that success will be more certain at a later period than at a very early one. Under these circumstances I always advise the operation to be postponed till after the third month; that is, when no necessity exists to hurry on the operation—such as inability to take food, &c. On account of this last-named condition, I have operated with complete success on the fifth day.

The position of the patient is important. If an infant, the whole body and arms should be bound round with a good towel, and the head fixed by the hands of an assistant placed on either side. The child should be firmly held in a nurse's lap in the sitting posture (Fig. 97).

FIG. 97.



If an older child, the semi-recumbent position should be chosen, with the head raised on a pillow and fixed as directed above. Chloroform should, under these circumstances, always be given. When chloroform is given to an infant the head may be laid on the surgeon's knees, the body on the nurse's. The operator may sit or stand behind the patient when the recumbent position is selected, or at one side if the patient is sitting.

The operation.—Chloroform may be given without fear in these cases, although in uncomplicated examples the operation is so expeditiously performed as not to render it essential; I operate as frequently without as with it.

There are two main objects the surgeon has in view—to pare the edges of the fissure, and adapt them, so as to render the deformity as slight as possible. But before this an important preliminary point demands attention; indeed, the success of the case rests materially

upon its due performance, and that is the free separation of both sides of the lip from the alveoli. When this has been achieved, the soft parts will move freely over the bones and be brought more readily into apposition. Some surgeons save the true frænum and divide all other adhesions; my experience does not indicate the necessity of this practice. To pare the edges the knife should be employed; such an instrument makes a cleaner section than scissors, and this cleanness of the incision is a point of importance. With respect to the form of incision, numbers have been devised, but most surgeons fall back upon the old-fashioned straight one, commencing at the apex of the cleft and ending at its free border, care being taken to cut off a good piece. It is a good plan, however, and one I now always adopt, when the knife reaches the red border of the lip to turn the edge obliquely towards the cleft, thus saving a portion of the mucous covering of the lip, by which the notch in the lip will be materially lessened (Fig. 98). The incision having been made, and any bleeding vessel twisted, the surgeon should proceed to adjust the parts, and he had better commence at the free margin. When pins are used, they should be fine with flat heads, and one should be introduced about a third of an inch from the margin of the wound, and brought out just under the mucous lining of the lip, reintroduced on the opposite side, and passed through the lip. The edges can then be brought together by means of a twisted suture, care being taken to adapt accurately the parts at the red margin of the lip. Should this end be obtained, the second and third pins may be inserted above, one close to the nostril, the second between the two, and both fastened separately. Should the interrupted silk, gut, or horse-hair suture be employed instead of pins, a practice I much prefer, having given up pins in simple cases, it is a good plan to introduce a needle as the first pin to adjust the parts, and then insert the second and third stitches, putting in afterwards the marginal suture by simply drawing the needle that had been introduced as a pin through the flaps. In some cases it is good to insert a fourth suture into the red border of the lip itself.

FIG. 98.



Lawson Tait has suggested a very ingenious plan of bringing the wound together ("Brit. and Foreign Rev.," 1870), of which the following is his description: "I introduce an ordinary seamstress's needle through the lip, in the plane of its surfaces, about half an inch from the prolabium, and bring the point out at the middle of the cut surface. I then introduce the needle at the corresponding point of the opposite cut surface, and again bring it out at the root of the ala of the nose. I introduce the second needle the same way. When both needles are *in situ* they form a St. Andrew's cross, the point of intersection being in the centre of the wound. The needles are then pushed home up to their eyes, and the wires with which they have been threaded twisted firmly together, the points cut off close to the skin, and the stumps retracted into it. Thus all possible scarring is avoided." I have tried this plan on one occasion and was much pleased with it.

FIG. 99.

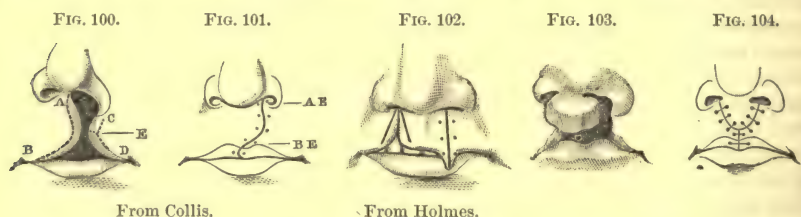


After the operation Hainsby's truss should be employed when possible (Fig. 99). It keeps the parts well together and prevents any traction upon the wound. It is a valuable instrument. When it cannot be obtained the cheeks should be well drawn forward and held by some good plaster applied from ear to ear, although when pins are employed this practice can

hardly be followed. The sutures or pins may generally be removed about the second or third day at the latest, and after their removal the cheeks must be held forward by strapping.

Mr. Maurice Collis, in 1866 ("Dub. Quart."), in an able paper on hare-lip, amongst other points laid great stress upon the propriety of utilizing the parings. He never threw away a particle of them, but used them all. I have followed his suggestions in some half a dozen cases with admirable success, and am disposed to think that in his main arguments he is right.

His operation is as follows (Fig. 100): He first makes an incision from A to B (Fig. 100), through the thickness of the lip down to the mucous membrane, but not through it, and turns the flap back. On the other side, he transfixes the lip at C, and separates the flap as far as D, dividing the flap in the centre of E. He then brings the two sides together, the loose flap covering in the semi-attached one in the central bit. The upper flap E is fixed by a suture to A, and the lower flap E to B. Two intermediate sutures being applied (Fig. 101), I thus get, says Collis, a lip nearly double in depth what I could possibly have got by the ordinary incisions. In harelip with unequal sides this plan of Collis is very excellent. Malgaigne's operation is in a measure somewhat similar, utilizing as it does the flaps of skin by turning them down and stitching them together (Fig. 102). I used to practice



this till I learnt Mr. Collis's. In other cases, one of the pared edges may be left attached and united with the opposite side that has been sloped to receive it. Both these plans are good; they are more applicable to slight cases of harelip than to the severe, where the notch includes the whole depth of the lip.

Double Harelip.—When this is uncomplicated with bone displacement, it may be dealt with as simple harelip; in a general way it is well to operate upon both sides at once, more particularly if the lower flaps of the lateral portions are utilized by being turned down and united beneath the central piece (Fig. 104). Should there be, however, much separation, and consequently traction upon the lateral portions, the operations upon the two sides should be performed separately.

When the intermaxillary bones project and are separated from the maxillary, there is some difficulty in the treatment; but the surgeon should always strive to preserve the projecting bones by separating them from their posterior attachments by means of a good pair of scissors, or by bending or breaking them back. Blandin's method of cutting a wedge-shaped piece out of the septum nasi will at times facilitate this measure. By removing them there must always be a permanent gap in the hard palate and a loss of some or all of the incisor teeth, for the intermaxillary bones always include the central incisors and as often as not the lateral. In replacing the bones, however, the surgeon must remember when doing so that to allow the incisor teeth to grow backwards, or in any abnormal position, would be worse than useless. On this account Sir W. Fergusson usually cuts them off.

When they are pushed so forward as to form a kind of appendage to the tip of the nose, as seen in Fig. 107, they must be removed.

The portion of skin over the bones must, however, always be utilized, either to form a *columna nasi* where none existed, as in Figs. 105 and 106, or to be brought down and inserted between the two lateral portions of the lip. Should primary union fail, the surgeon will often succeed by scraping the surface of the wound and reapplying the sutures. He may do this, although the parts have sloughed at first, as soon as healthy granulations appear.

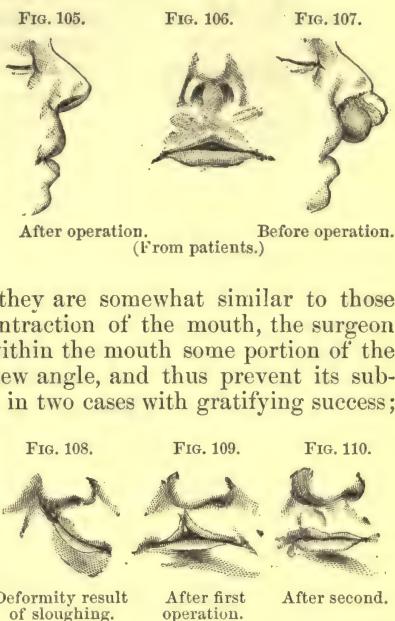
Cheiloplastic Operations.—These are demanded for deformity of the mouth from destructive ulceration or sloughing, as from *cancerum oris*; they are somewhat similar to those for harelip. When undertaken for contraction of the mouth, the surgeon should always try and turn up from within the mouth some portion of the mucous membrane to cover over the new angle, and thus prevent its subsequent contraction. I have done this in two cases with gratifying success; one is figured below; the deformity was the result of sloughing after fever. In some cases new tissue will have to be brought up from the chin or down from the cheek; indeed, these cases tax the ingenuity of the surgeon to the utmost, for no general rules can be laid down; each case must be treated on its own merits. But this may be said—that no part of the body heals so rapidly or so well as the face, and in none are plastic operations more satisfactory.

Cancer of the Lips.—This term is generally applied to epithelioma or canceroid disease, true cancer or carcinoma being very rare. It is a disease of middle life, four out of five cases attacking patients between 40 and 60 years of age. The youngest subject I have seen affected by it was a sweep aged 27, and the oldest was a sweep aged 86. It affects the lower lip more frequently than the upper, in the proportion of 50 to 2, and men more frequently than women. In my own table three instances of the latter exist to fifty-one of the former.

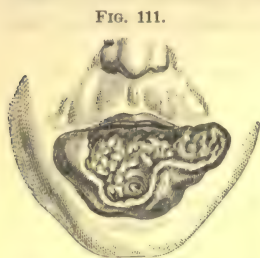
Smoking, or rather the irritation of a pipe, has generally been put down as a common cause, and it is probable that such an irritation is sufficient to set up the disease when a predisposition to its development already exists. It is interesting to note that in fifty-four consecutive cases in which I made the inquiry nine had never smoked. This proportion is probably about that of the non-smokers in this country amongst the male population.

The disease generally commences as a dry scab on the red margin of the lip; it may be that this scab forms over a crack or excoriation, but as often as not it appears alone; sometimes it commences as a wart. In its early stage the progress of the disease is generally very slow, and it is only when some ulcerative action appears that it develops more rapidly. It is under these circumstances that the patient first applies for advice; in the dry stage it is passed by unheeded.

The appearance of an epithelial cancer is tolerably characteristic (Fig.



111); it has generally an irregular warty aspect, and when ulcerating it has thickened everted edges. It has always a well-defined indurated base; when ulcerating it discharges a sanious pus, containing epithelium scales in abundance; when dry it is covered with a scab of the same material. Microscopically it contains epithelial elements arranged in capsules. (*Vide* chapter on tumors.)



Cancer of lip in John C—, æt. 54.
From drawing.

It seems to be a local disease in its early stage, and rarely affects more than one part at the same time. I have, however, seen several cases in which two separate centres existed, and in one case there were three; in this case two growths on the lower lip were excised, and nine years subsequently a similar disease attacked the tongue. In June, 1870, I removed this with the galvanic-cautery *écraseur*.

When the ulcerative stage has set in, the glands beneath the jaw will probably soon become affected, if the disease be left to run its course. Indeed, under these circumstances the progress of the affection will be steady, if not rapid; it will go on to destroy all the tissues with which it comes in contact—integument, gums, bone, teeth, and glands. It destroys life by exhaustion. It may do so by secondary deposits in the lungs or viscera, but far less frequently than in carcinoma.

TREATMENT.—There is only one form of treatment that can be recommended, and that is the speedy removal of the disease. When once the nature of the case is clear the sooner it is taken away the better; the surgeon, in doing this, must also deal freely with the parts around. He had better err by taking away too much of the surrounding tissues than too little. To tease the part with mild caustics is bad practice, it merely irritates and rarely destroys the whole growth. Cauteries are not, as a rule, to be recommended. Excision is probably the best method. When the disease is superficial, it may be sliced off, leaving the parts to granulate; when it involves more of the lip, a V-shaped piece may be taken out, the two edges being brought together as in harelip. When much of the lip is affected the whole of it must be removed, and a new lip formed by bringing up the soft parts from the chin as indicated in Figs. 112, 113.



Diagram showing the lines of incision for new lip after removal of a cancer.

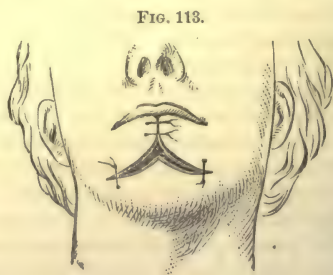


Diagram showing position of flaps when brought up.

I have, however, with the galvanic cautery removed many superficial cancerous tumors of the lip with success, isolating the growth with pins and removing it with the wire passed beneath them.

After the removal of the disease a cure may follow; but in the majority of cases a return will take place, and generally in the same spot. Similar treatment must again be adopted, even to a second and third operation, for there seems reason to believe that after each operation a longer interval of immunity may be promised. Thus, a man who had a cancer of the lip removed one year after its appearance, was well for two years, when a second operation was required; he remained well for three years, when a third was performed, and this time four years elapsed before a return took place. It was then excised for a fourth time.

In another case a man, *æt.* 65, had a cancer of his lip removed fifteen years before he came under my care. He remained well for eight, when a return and a second operation took place; seven years after this he was well. Epithelioma of the lip is of slow growth. I lately removed one from a man, *æt.* 74, of twenty years', and another from a man, *æt.* 50, of eight years' growth.

Horny Growths may spring from the lip as from other parts of the cutaneous surface. (*Prep.* 1678^s, *Guy's Hosp. Mus.*)

Chancres, syphilitic or otherwise, are at times met with on the lips, and the surgeon should be on his guard not to mistake them for cancer. They have neither the clinical history nor aspect of such an affection, having a far more rapid progress. They are likewise usually attended with much inflammatory swelling and secondary glandular enlargement. When syphilitic, the constitutional symptoms will mark their true nature. They are, moreover, usually met with in younger subjects, than is cancer.

Hypertrophy of the Mucous Glands of the Lip.—The mucous covering of the lip is often found to be thickened, two elevated or pendulous portions of tissue appearing, one on each side of the middle line, which authors have described as *Hypertrophy*. This does not, however, appear to be correct, for on removing the so-called hypertrophied mucous membrane a number of small granular bodies, the size of hemp-seeds, made up of gland-cells, are always found underlying a healthy mucous membrane. The disease appears, therefore, to be due to an increase in the size of the natural glands of the part, and not of the mucous membrane (*Fig.* 114). It is to be treated only by the careful excision of the diseased submucous tissue—the incision being made in the line of the lip, and the edges brought together by fine sutures. I have seen as many of these cases in the upper as in the lower lip; it rarely involves both. I have never known the removal of the disease to be followed by a return.

A genuine hypertrophy of the lip itself is a common affection. It often begins as a chronic inflammation of the part, or rather *œdema*, the inflammatory deposit becoming organized. Many of the so-called thick strumous lips have this origin, there is little doubt. Attention to the general health and its improvement are the means by which any cure may be expected.

Cystic Tumors of the Lip.—**Mucous cysts** are often seen, and generally in the lower lip. They appear as tense, globular, and at times semi-transparent tumors beneath the mucous membrane. They are readily cured by excision or by cutting off their upper wall by means of scissors and sharp-pointed forceps. An incision into them rarely does good. They contain a glairy mucoid fluid. On two occasions I have turned out of the lip,

FIG. 114.



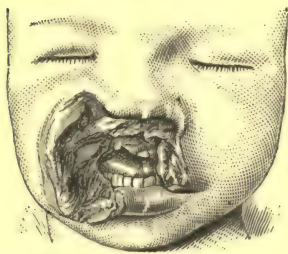
from beneath the mucous membrane, solid tumors, with a glandular structure and encysted.

Nævi of the lip are often seen, and when they involve the whole thickness of the part their excision by a V incision is the best treatment. I have done this on three separate occasions with a good result. When they are only superficial or beneath the mucous lining they may be treated locally, as already mentioned in the chapter on *nævus*.

Phlegmonous inflammation of the lip is an alarming affection; it is never found except in the feeble and cachectic. It attacks the upper as well as the lower lip, and shows itself as a general infiltration of the part, which becomes enormously swollen, tense, and painful. When seen in an early stage a free incision into it or its mucous surface gives relief and expedites the sloughing of the cellular tissue that is sure to follow. Fomentations and warm water dressings are the most beneficial, with good living and tonics, such as quinine and iron in full doses. At times this affection ends in sloughing, and then puts on the appearance of what is called *cancerum oris*. It is very prone to be followed by *septicæmia*.

Cancerum Oris, or Gangrenous Stomatitis, is generally met with in the ill-fed and feeble child after one of the *exanthemata*. It is seen also

FIG. 115.



Model 26¹. (Guy's Hosp. Museum.)

where mercury has been given to salivation. It often commences as a phlegmonous inflammation of the cellular tissue of the cheek or lip, which goes on rapidly to sloughing and phagedænic ulceration, or to sudden death of a part of the cheek, the tissue becoming white and bloodless, rapidly passing on to sloughing. At times this sloughing process will involve a large portion of the cheek, and even of the gum or bone. It is a most dangerous and fatal disease. Before the sloughing has taken place the part involved will be much thickened and indurated. It will feel of a brawny hardness, and appear of a dusky

color in the centre, with a red border. When the skin covering in the dead cellular tissue has sloughed away, a deep, excavated, irregular surface will be seen discharging an offensive sanious fluid, and if the disease spreads it does so by sloughing and ulceration (Fig. 115). It generally kills by exhaustion, sometimes by bleeding from the sloughing of an artery.

TREATMENT.—The general treatment is that by tonics and good feeding, milk, eggs, and wine, beef tea, and any other nutritious food, being of primary importance. When food cannot be taken by the mouth it must be given by the bowel as *enemata*. Tonics also must be administered, as the *liquor cinchonæ*, quinine, or iron, in such doses as the child will bear.

Locally, till the slough has separated, little more than fomentations and cleanliness can be employed; but when sloughing and ulceration are spreading the application of strong nitric acid is of great value. It must, however, be liberally brushed over and into the parts, so as to destroy all their surface and induce a fresh action in them.

Absolute cleanliness should be observed, the wound being washed and irrigated by means of a steady stream of water, to which carbolic acid 1 part to 20, Condyl's fluid, chloride of zinc or nitric acid, ℥v to the ounce, may be added. When recovery takes place it is frequently with the loss

of large portions of the affected parts, for which some plastic operation will subsequently be needed.

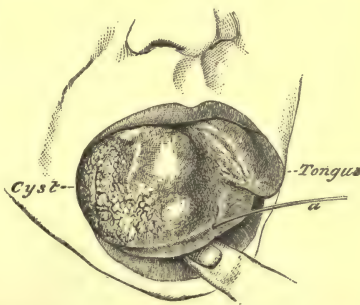
Aphthous Stomatitis is another affection that is often mistaken for *cancrem oris*; it is not, however, half so dangerous. It occurs likewise in the unhealthy and ill-fed child, but as often as not is independent of the exanthemata. It begins as an aphthous ulceration of the tongue, gums, lips, or cheeks, by which these parts become covered with a white or ash-colored secretion. With these local symptoms there will be a foul tongue and fetid breath, with some evident symptoms of derangement of the bowels and digestive organs. In very feeble children this superficial ulceration may pass on to sloughing of the parts, or *ulcerative stomatitis*, thus simulating *cancrem oris*; but there is this difference—in *cancrem oris* the disease begins in the cellular tissue, the skin sloughing subsequently; in *ulcerative stomatitis* or *noma* it begins as a skin or mucous membrane ulceration, sloughing following upon it.

TREATMENT.—Of all drugs the chlorate of potash has the best action, given in five or even ten grain doses mixed with bark, or with the milk of the ordinary diet, a lotion of the same drug, ʒj to a pint of water, being used as an application. Milk diet is the best where it can be taken, beef tea and eggs being given otherwise or in addition. Wine must be administered with great caution, and only when the powers of the child are very feeble, as in the phagedænic form. A rhubarb purge is usually required at the beginning of the affection to clear the way, as foul excreta are too often present, and in the latter stage the more powerful tonics, such as iron or quinine, are often wanted. It is a disease that is generally due to intestinal irritation from bad feeding, and requires, therefore, for its treatment careful attention to this point.

Ranula or Sublingual Cysts.—These are now known *not to be* due to any obstruction of the salivary ducts, submaxillary or sublingual, but to obstruction of one of the mucous glands that are situated beneath the tongue, such as the glands and ducts of Rivini; they are probably analogous to the mucous cysts of the lip, that have been already alluded to, and of the mucous passages generally. They contain a clear, glairy, mucoid fluid, never saliva. I have the notes of several that were *congenital*. They sometimes attain a large size, and when placed beneath the tongue, their usual position, the salivary duct can readily be traced lying over them (Fig. 116). Sometimes they are multiple, and on several occasions on opening one cyst I have seen a second within. When neglected and allowed to increase they may so press the tongue upwards as to prevent the patient speaking, or they may form a large swelling beneath the jaw.

From within the mouth they appear as semi-transparent cysts beneath the tongue; they are painless as a rule, and merely give trouble mechanically; when opened a glairy mucoid fluid escapes. This operation, however, rarely does good, for the fluid re-collects. The best plan of treatment is to raise the upper surface of the cyst by means of a pair of pointed forceps or a tenaculum, and cut off with scissors the upper surface of the cyst. In large tumors the cavity may be plugged with lint soaked in iodine, after

FIG. 116.



Guy's Hosp. Mus. No. 229²⁶. Hilton's case.

it has been freely incised. The application of a seton is at times good, but it is an uncertain remedy; simple plugging of the cyst was a mode of treatment that I used to employ till I found out the plans suggested were better. It is impossible to excise these cysts, they have no definite walls.

Encysted Tumors are, however, met with beneath the tongue; I have had two under care, and both I took for ranula. I discovered my error only on opening them; in both on making my incision I had to cut through the mucous lining of the mouth over the cyst, and the cyst-wall itself. In both a cheesy sebaceous secretion escaped.

These tumors have nothing to do with ranula; they have distinct capsules beneath the mucous membrane; they appear to be sebaceous, and are probably congenital. In both the cases I have mentioned the patients were under twenty years of age; in both I pulled out as much of the cyst-wall as I could, and dissected it from its bed, in one with complete success; in the second a return took place, which called for a second operation, which was followed by a good result. I have never known any of these sublingual cysts require removal from below the jaw; the sebaceous form might do so. In one of my cases I contemplated this plan. Sir W. Fergusson gives a case where this practice was adopted. It is probable, however, that plugging of the cyst, to set up suppuration, would be a simpler and equally efficacious practice.

Salivary Calculus.—The salivary ducts beneath the tongue may, however, be obstructed, and the common cause is that of a *calculus*. Steno's duct or that of the parotid may similarly be affected, but this is a rare incident, the Whartonian or the sublingual salivary ducts being the more commonly involved. When the obstruction is complete patients complain at times during deglutition of pain in the corresponding salivary gland, and some swelling, these symptoms being clearly due to retained salivary secretion; these symptoms, however, soon subside on the completion of mastication. In exceptional examples suppuration may attack the gland.

This affection can usually readily be recognized on the application of the finger beneath the tongue, the calculus, as a rule, holding a superficial position. On feeling the stone the surgeon may often with his nail tear it out of its bed. I have removed several when not larger than hemp-seeds by this plan. When larger the best plan is by incision, the surgeon being careful to cut through the duct where it seems the thinnest over the calculus, and scooping it out of its bed by means of a director or bent probe. At times these calculi attain considerable dimensions, even one inch long. A few months ago I broke a calculus to pieces in attempting to remove it from the centre of a suppurating sublingual gland; a rapid recovery followed its removal. It was in a man *æt.* 42, who had had evidence of its presence for years; he came to me with the parts hard and ulcerating, having been told he had a cancer.

Salivary Fistula.—When Steno's duct, that of the parotid gland, has been obstructed near its orifice in the mouth, or has been opened by a wound or ulceration, a salivary fistula may take place, that is, the saliva, instead of being poured into the mouth, will escape upon the cheek. When it originates from some obstruction to the duct itself, it will first commence as a soft fluctuating swelling in the cheek, this swelling being caused by retained salivary secretion; after a time, and usually when the duct has acquired about the size of half a walnut, the swelling will ulcerate through the skin, when clear saliva or saliva mixed with pus will escape. Should this swelling be opened by the surgeon the same result will ensue. After this the cavity may contract, but the fistula will remain.

The only successful treatment is to establish a free opening into the

mouth from the oral end of the duct, and this may be done by passing a fine probe into the fistula through the duct and into the mouth. When this can be done through the natural opening all the better, but this is not a matter of much importance, for an artificial opening near the oral orifice of the duct will answer every purpose. This probe should be armed with a piece of thick silk, or three or four threads of fine silk, and drawn through the mouth, the ends hanging from the cheek and those from the mouth being tied together, the whole acting as a seton, to establish an artificial fistulous communication with the mouth. After about a week or ten days this end will probably be secured, when the seton may be removed. The fistula in the cheek will then probably contract and close of itself; should this not take place the edges of the fistula may be cauterized by the galvanic, gas, or actual cautery, and thus cicatrization be encouraged. The operation may be repeated should it be required. A plastic operation may be attempted should these means fail.

I have known parotid salivary fistula follow upon the suppuration of the gland after fever in three cases, the orifice in all being a small one and placed behind the angle of the jaw. In none of these was it associated with any obstruction to Steno's duct. It was troublesome only from the trickling of saliva during mastication, and one of the patients being a lady it caused much annoyance. I tried the cautery in one, but without success.

Parotiditis or "mumps" is a simple, although an infectious, disease; it has a tendency to get well with simple fomentations to the parts, a saline purgative, and some mild tonic. It is occasionally metastatic to the testicle or neck.

When it follows upon a fever, it not infrequently passes on to suppuration; such abscesses spread easily, the deep fascia covering it in forbidding a natural outlet except by burrowing. Salivary fistula in the neck may follow in such a case.

Parotid Tumors with Submaxillary Tumors have this peculiarity, that they are almost always more or less cartilaginous, the ordinary form of tumor in this region being the fibro-cartilaginous; they are, moreover, mostly encysted, and have a peculiar hard elastic feel and botryoidal outline. They are generally imbedded in the structure of the gland, and vary much in their depth; tumors that appear to be movable and superficial too often dipping well down into the tissues, and thus increasing the difficulty of their removal. These simple tumors may grow to a great size, and stretch the skin greatly over them; they should always be removed, and the earlier the better. In removing them the surgeon should be careful to make his incision well down to the capsule, after which he will probably be able to enucleate the growth: it is far better practice to do this, even with the application of a little force, than to be too free with the knife, for the facial nerve is generally in close contact with the tumor and the deep vessels beneath. The surgeon should also always cut upon the tumor, dividing only such tissues as hold it down, care being taken always that the large vessels are left uninjured, if possible. In deeply placed tumors this removal by enucleation is still more necessary. When the tumor is large there is always a strong probability that the facial nerve will be divided or destroyed, and it is as well, therefore, to prepare the patient for the fact. Fig. 117 illustrates the situation and external appearance of the ordinary parotid tumor.

FIG. 117.



Drawing 197^{ss}. (Guy's Hosp. Museum.) Mr. Birkett's case.

Cancerous Tumors of the Parotid are likewise met with, but they put on a very different appearance from the last. They are mostly infiltrations of the gland, and feel fixed, diffused, and deepseated; they are generally associated with paralysis of the facial nerve, in this way differing from innocent growths. They should never be surgically interfered with.

The difficulty of deciding as to the removal of large growths in this position is very great, and the best guide to the surgeon is their mobility. Sir W. Fergusson, who has had more experience in these cases than any man living, says, "If it were evident that the part slid freely over the subjacent textures, I should not hesitate about using the knife, whatever might be the bulk of the disease," &c.; "but if the tumor seemed fixed, its limits were not clearly defined, or an attempt to move it caused pain, I should not readily be induced to use the knife, however small the mass might be." In these opinions I cordially agree.

Affections of the Tongue.—Tongue-tie is occasionally met with by the surgeon, but not a tithe of the cases reputed to be so, are of this nature. It is due to a tying down of the tip of the tongue by the frænum linguae, which prevents the infant from projecting the organ beyond the gums, and thus interferes with suckling. It is easily remedied by dividing the frænum with a pair of blunt-pointed scissors, perpendicularly downwards behind the gum, the point of the tongue being elevated with the finger, or a pair of dressing forceps applied beneath.

Wounds of the Tongue.—These are sometimes troublesome from hemorrhage, but when the parts are brought together, the bleeding as a rule ceases; sutures should always be employed when gaping exists. Should, however, a bleeding vessel be visible, it should be tied or twisted. The sutures must be put in deeply, to draw the whole thickness of the divided parts together. On one occasion, owing to a neglect of this practice, I had to pare the surface of an old wound of the tongue, that had passed through the half of the tongue transversely, and bring the parts together. The child was unable to talk clearly before on account of the injury; afterwards all was well. If bleeding is obstinate, and the parts cannot be brought together, the cautery or perchloride of iron may be usefully employed. In exceptional cases the ranine artery may require a ligature. Ice in the mouth arrests slight hemorrhage.

Hypertrophy of the Tongue.—This is a troublesome affection, chiefly from the mechanical obstruction which it causes. It is mostly found in young subjects, and is sometimes congenital. It has been said to be the result of chronic inflammation of the organ, but that such is always the case appears doubtful. When it has existed for years it may cause distortion of the jaws. It may involve the whole organ or only its half; in a case I had under my care not long ago, this latter condition was singularly well illustrated. It is to be recognized simply by the increased size of the organ, no external evidence of disease usually existing. The enlargement, as a rule, is painless, though when the tongue cannot be kept in the mouth, the disease is a distressing one; it is not often amenable to treatment. In the case of a boy, æt. 6, who was originally under the late Dr. Addison's care at Guy's, for a congenital enlargement of the organ, the perchloride of mercury in small doses reduced the size of the organ, so as to allow of its return into the mouth, and although several relapses took place in later years, the same treatment was repeated with an equally good result. In a gentleman, æt. 20, who consulted me some fourteen years ago for enlargement of the tongue of twelve years' standing, attended with protrusion and all its evils, iodism induced by ten-grain doses of the iodide of potassium, was followed within a week by the speedy disappearance of the affection, although at the

time the death of the patient appeared imminent from the excessive swelling of the organ caused by the drug. In other cases the removal of a wedge-shaped piece from the centre of the organ is the best practice; to cut off the projecting portion is far less satisfactory. The application of ligatures to the lingual arteries might possibly be of use in these cases to starve the disease.

The tongue may likewise be the subject of *ichthyosis*, of *warty growths*, and congenital *pedunculated* growths. Messrs. Paget and Hulke ("Trans. Clin. Soc.," vols. ii and iii) have recorded examples of the former, and several of the latter have come under my notice. They should always be removed. Cases are also on record of *fatty tumor*, *fibro-cellular tumor*, and *hydatid of the tongue*.

Glossitis.—Inflammation of the tongue, when deepseated and general, is a grave affection, for the swelling may be so sudden and severe as to threaten life by suffocation. In the sudden enlargements from the salivation of mercury or iodism, as in the case already given, these facts are at times seen, but as a rule the symptoms rapidly subside under local fomentation on the removal of their cause. Should suffocation be threatened by the œdematous enlargement of the organ, free vertical incisions might be required, but I have not yet seen a case where such a practice was demanded. Inflammation ending in local suppuration is far more common; and when an abscess has formed the sooner it is opened the better. Should it be placed at the root of the tongue, both deglutition and speaking will be interfered with; indeed, the abscess may mechanically so press upon the epiglottis as to close the larynx, and threaten life.

Local inflammation of the tongue may come on without any known cause, or from the contact of some irritating substance such as that of a weed. It may also follow some wound.

TREATMENT.—Fomentations to the part frequently applied, and an incision into the abscess as soon as it can be made out, are the best local means. Tonics after the use of a mild purge are also usually useful. When the swelling becomes mechanically dangerous, the œdema may be dispersed by an incision or a puncture, but the surgeon need not be in a hurry to adopt this practice; it is rarely needed. The application of leeches to the organ when projecting has been followed by rapid relief.

Aphthous Inflammation of the tongue and superficial ulceration are not uncommon. It occurs in children chiefly from alimentary irritation, and is cured by the chlorate of potash internally in five or ten grain doses as in aphthous stomatitis.

Simple or Dyspeptic Ulcer of the tongue is a rare affection and a very obstinate one. The few cases that I have seen of it have been in adults in whom considerable disturbance of the digestive apparatus existed. In one the patient passed lithic acid in such abundance as to startle me. He used to bring it in spoonfuls weekly. The ulceration may be extensive, but it is always superficial, and the tongue is usually glazed with it and often red. To the finger it does not feel hard.

TREATMENT.—The only sound treatment is a soothing one. Clear out the bowels by a mild purgative such as castor oil, rhubarb and magnesia, and give alkalies, such as the bicarbonate of potash in gentian, calumba or bark, or the chlorate of potash. Regulate the diet in the most careful way, forbidding all food that can possibly irritate. Milk when it can be taken should be allowed. Beer and spirits are generally bad; some little wine or dry sherry may be allowed when necessary. Locally, the chlorate of potash lotion is the best. Caustics and other stimulants are rarely needed.

These cases are not to be mistaken for the syphilitic or condylomatous

affections of the organ which are less superficial, more raised and indurated, and are, moreover, usually associated with patches on the throat, lips, or cheek, and other constitutional symptoms; nor with the fissures or ulcers that are often found at the side of the tongue due to the irritation of a stump or tooth.

Deepseated Ulcers of the tongue may be *simple*, *syphilitic*, or *cancerous*. The first is very uncommon, and is usually the result of a local abscess. It can be made out by the sharpness of the edges of the sore, the absence of induration, and the fissured aspect of the ulcer. It has a tendency to get well.

The Deepseated Syphilitic Ulcer is generally the result of a breaking down of a gummatous tumor in the thickness of the organ. As a tumor it appears as an induration of the part; as an ulcer it appears deeply excavated, with irregular but not infiltrated or everted edges. It is slow in its progress, and not so painful as cancer. It is, moreover, usually found with a history or other symptoms of syphilis and more in the body of the tongue. It may be mistaken for cancer, and I take it most of the cases of so-called cured cancer of this organ are of this nature.

Cancer of the Tongue is usually epithelial. It is most common between forty and sixty years of age, is more frequent in men than women, in the ratio of five to two, and generally commences and is confined to one side of the organ; an analysis of fifty-five cases ("Just. Schmidt's Jahrb.," 1860), telling us that it involved both sides only in nine. It begins more frequently as a crack or ulcer than as a wart, and soon gives rise to pain. It increases with variable rapidity, but the majority of patients seek advice after it has existed a few months. It is usually to be recognized by the irregular surface of the sore, its indurated and often everted edges, hardened base, and sloughing surface. As time goes on the glands beneath the jaw will become enlarged, the ulcer with the disease will infiltrate all the tissues as it increases, and the patient's powers will become enfeebled, hemorrhage from some large vessel too often at the end destroying life.

TREATMENT.—Most surgeons now admit that the sooner the disease is removed the better, for there seems good reason to believe that it is at first a local affection, and that on its removal a cure may be obtained. Should this end not be secured, much good will be gained by the operation, for at any rate it relieves a patient for a time from a most distressing and exhausting affection. The operation, moreover, is attended with marvellously little risk to life, and is followed by improved articulation even when the whole organ has been removed. In the case figured (Fig. 119) the man could speak as well after the operation as before.¹ There are only two modes by which this removal *should* be effected, *excision* and the *écraseur*. Caustics are painful and uncertain, and have been rightly abandoned. The ligature is painful and tedious and beyond the freedom from hemorrhage it it has no advantages; and in this it is only equal to the *écraseur*. It is useful only for timid surgeons. In excising the disease the surgeon must be careful to remove the whole, cutting well free of its margins; at the same time, when a portion of the organ only need be sacrificed, no more should be removed. It is wiser, however, to take off too much than too little.

When the disease is limited, and in front, excision may be employed, for with the tongue held well out with a suitable pair of forceps (Fig. 118), or by a ligature passed through the tip, all vessels can be tied or twisted,

¹ Vide Syme's case, "Lancet," 1866.

and bleeding controlled. When the galvanic *écraseur*, or *écraseur* wire heated by the galvanic battery, can be obtained, no better means are required for removing small or large portions of the tongue; with pins put in to isolate the growth, and the wire carefully adjusted behind them, any sized mass can readily be removed by a bloodless operation. With the ordinary wire *écraseur* there is more difficulty in removing small portions. The amount of tongue that can be removed through the mouth by these means is measured only by the appliances the surgeon has at his command to fix its posterior boundary. In

FIG. 118.

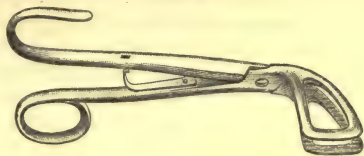


FIG. 119.

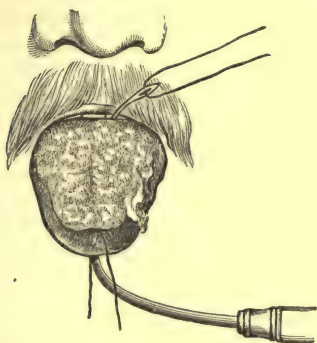
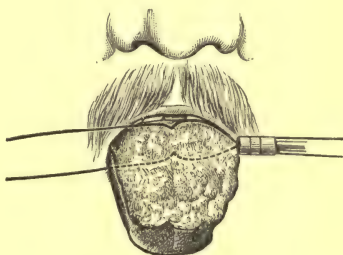


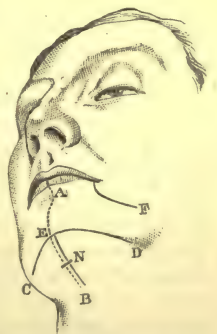
FIG. 120.



the case figured above more than the anterior two-thirds of the organ were removed, and by means of the curved needle given in the drawing no difficulty was experienced in passing the ligature or removing the organ.

When the diseased tongue cannot be with safety excised, or with certainty surrounded through the mouth, various expedients have been suggested. Professor Syme divided the lower lip and jaw in the median line to give room for the operation (A to B, Fig. 121). Regnola, of Pavia, made an incision from the hyoid bone to the chin, and two lateral ones from the anterior extremity of this along the lower border of the jaw, dividing all the tissues through to the mouth that connected the tongue with the lower jaw at the symphysis, thus giving abundant room to draw the tongue downwards (B to E and C to D, Fig. 121). Nunneley, of Leeds, introduced beneath the jaw, between its base and the hyoid bone, a sharp-pointed curved knife, four inches long, and brought it out in the mouth at the *frænum linguæ* (N, Fig. 121). With a probe guided upon this knife he then drew through the wound the wire rope of the *écraseur*, drawing a good loop through the mouth, and withdrawing the probe, the two ends of the rope hanging beneath the chin. He then seized the tongue with forceps, and forcibly pulled it out of the mouth, and pushed through the base of the tongue three long and strong pins, making their ends appear in its upper surface near the base, and behind

FIG. 121.



Illustrating the different operations for the removal of a tongue.

the disease. He then passed the loop of the *écraseur* behind the pins and drew it tight, thus completely encircling the whole organ. The process of removal then went on. Sir J. Paget improved upon this, doing away with the submental puncture, and giving freedom to the tongue by dividing the soft parts that hold it down at the floor of the mouth, close to the bone, thus allowing the organ to be pulled well forward. Paget at the same time rightly insisted that care should be taken to divide the tongue perpendicularly through its thickness, and not obliquely; this point is, however, guaranteed by the introduction of pins, as already mentioned. Collis, of Dublin, went one step further, and instead of using the knife as suggested by Paget to divide the sublingual tissues, employed the *écraseur*. He has, moreover, advised the cheek to be laid open from below its angle to give room for manipulation when the disease is far back (F Fig. 121). By one or other of these means room can be obtained to free the tongue from its attachments, to isolate the growth by pins, and remove it by the *écraseur*, wire rope being used when the galvanic cautery *écraseur* cannot be obtained.

When the disease is placed anteriorly, the introduction of pins through the mouth and the *écraseur* are all the means required. When more room is needed, Collis's, Paget's, or Nunneley's plan may be employed. When the disease cannot be isolated by these means, Syme's operation must be had recourse to, in which case it will be well to act on a suggestion of Sedillot's, and make the section of the jawbone irregular, to allow of a better adaptation of the segments afterwards than can be insured when the line of division is a vertical one. The use of the knife had better be confined to the removal of small tubercles in the front of the tongue; all larger pieces are removed with equal facility, and with the loss of less blood, by the *écraseur*.

Ligature of the Lingual Arteries has been practiced by M. Demarquay ("Gaz. Med.," 1867) on three occasions, for the purpose of starving a cancerous tongue, with good result; such a proceeding is, however, only applicable when the removal of the organ cannot be entertained.

Division of the Gustatory Nerve has likewise been practiced with success by Hilton (1850) and Moore (1861) for the *relief of pain* in these cases. It can readily be divided by an incision made between the last lower molar tooth and the anterior pillar of the fauces, behind, below, and parallel with the alveolar ridge, as it ascends into the coronoid process.

Fissures of the Palate.—The hard and the soft palate are both liable to fissure, partial or complete, or indeed both palates may be involved. It may be that the fissure appears as a mere notch in the alveolar process, in the line of junction of the superior maxilla with the intermaxillary bone, as is seen so commonly in harelip, or it may pass backwards towards the velum; on the other hand, the soft palate may show only a bifid uvula or a complete fissure. The fissures in the hard and soft palates are always in the middle line, although where they involve the alveoli they diverge as they involve one or both intermaxillary bones; in fact, they invariably follow the line of suture, as seen in Fig. 91, page 233. Fissure of the soft palate alone is more common than fissure of the hard. It is very rare, however, for the intermaxillary bone to be so displaced, as is seen in Fig. 96, without fissure of the palate. These malformations, when severe, give rise to much difficulty in sucking and deglutition, the food passing through the nose. They likewise often interfere much with speech. Partial fissures are of little importance.

TREATMENT.—When fissure of the palate coexists with harelip, the lip may be operated upon as usual, irrespective of the fissure, but it will be

well for the patient to wear one of Hainsby's trusses (Fig. 99) subsequently, as the steady pressure of the pads has doubtless a good influence in bringing the bones together. Operations for the repair of the fissure have till recently been put off till the child was of an age to give assistance to the operator. Billroth was the first surgeon to operate in infancy. He did so with success on a child twenty-eight weeks old in three operations. In 1868, Mr. Thomas Smith introduced to the notice of the profession a gag (Fig. 122), that holds the jaws open and depresses the tongue, enabling the surgeon, with the patient under the influence of chloroform, to undertake the operation at a very early period; indeed, Mr. Smith has quoted cases where he operated at three years of age ("Med.-Chir. Trans.," 1868; St. Barth. Hosp. Rep., 1871). At the age of five, in a healthy child, it may generally be undertaken. I have performed it successfully at four years of age.

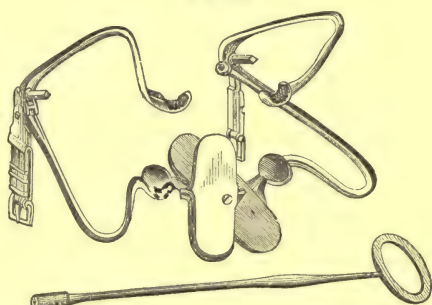
Roux was the first who successfully practiced the operation, having in 1819 successfully treated a medical student for cleft palate, and Dr. Mason Warren, of Boston, did much towards encouraging the practice; but in this country there is no doubt that to Sir W. Fergusson is due the credit of having demonstrated the value of the operation and of suggesting improvements therein. In his chief paper, published in 1845 ("Med.-Chir. Trans."), he showed "how the *levator palati* on each side had such free and uncontrolled action that, whenever excited, it drew the margin of the cleft outwards and upwards, and so tugged upon the stitches put in by the surgeon, that ulceration in their sites was a most probable result." He therefore suggested the division of this muscle in all cases, and that of the palato-pharyngeus in some. He did this by means of a curved knife (Fig. 123) passed through the fissure, so that its point can be laid on the tissues immediately above the soft velum, midway between its attachment to the bones and the posterior margin, and about half-way between the velum and the lower end of the Eustachian tube. The point is then thrust deep, and carried half an inch or more backwards and forwards, so as to cut the *levator palati*. By these means the palate is paralyzed for a time, and thus repair goes on with greater certainty.

For fissures of the hard palate much has been done in more recent times. Dr. Mason Warren, in 1843, described the process of separating the hard from the soft palate with the view of its closure, and it has been left to Langenbeck, Billroth, Pollock, Avery, Lawson Tait, Annandale, and others to perfect the process.

The operation.—Chloroform is not necessary in a patient old enough to understand the necessity of being still, and of assisting the surgeon. In young children with Smith's gag it is an advantage.

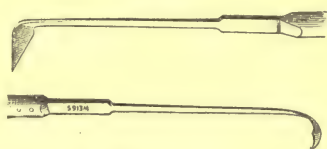
The recumbent position, with the head sufficiently thrown back, is prob-

FIG. 122.



T. Smith's Gag.

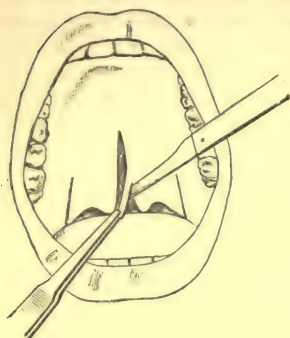
FIG. 123.



Fergusson's Knives.

ably the best, although some surgeons make the patient sit. The operator

FIG. 124.

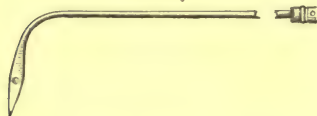


should stand on the patient's right side or in front. The steps of the operation are as follows: Pare the edges of the fissure; pass the sutures; paralyze the muscles; and fix the stitches. To pare the edges a blunt-pointed bistoury should be used, and a thin border of mucous membrane cut off from below upwards, the bifid uvula being held by a tenaculum-pointed forceps (Fig. 124). The incision should be made as clean as possible. When the incision is made from above downwards a sharp-pointed bistoury is needed. To pass the sutures a corkscrew needle (Fig. 126) is the best, or a curved needle flattened laterally (Fig. 125) with an eye in the end; but many ingenious devices have been made for

the purpose. The lowest suture should be inserted first, and both ends held, this practice facilitating the introduction of the others. The best material for sutures is fine gut; Mr. Smith uses horsehair for the lower stitches. I have rarely used anything but gut for all plastic operations for the last ten years, taking the precaution to select it and to soak it for some minutes in water before using it.

Should Fergusson's plan of paralyzing the muscles be employed, it must be done as he advises as a preliminary step to the operation. Should

FIG. 125.



Smith's Needle.

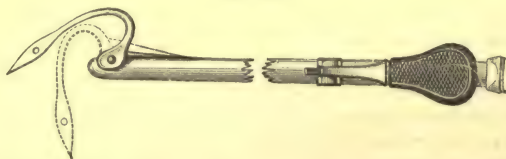
FIG. 126.



Corkscrew Needle.

Sedillot's or Pollock's plan be followed (Fig. 128), it may be done now by inserting a knife through the velum about a third of an inch from the highest suture, and cutting along the posterior edge of the hard palate

FIG. 127.



towards the free margin, but not through it; it is the one I have till recently adopted. The two pillars of the fauces may then be snipped with scissors. The sutures have now to be fastened, and the best plan is to run a perforated shot over the gut and clamp them, tying the ends of the gut in a knot to prevent the possibility of their slipping (Fig. 128). I usually begin at the highest. Care should be taken not to draw the stitches too tight. The parts should be sponged as little as possible, and the less manipulation there is the better; any irritation causing so free a secretion of mucus as to interfere greatly with the surgeon's proceedings. Rapidity in operating is consequently an advantage. When the parts require to be

cleansed in the adult iced water may be used as a gargle; with a child under chloroform, Mr. Smith tells us that the stitches may be inserted and the edges pared before any cleansing is required. In deep mouths where difficulty is experienced in passing the sutures a clever manœuvre suggested by Avery may be called for; it is illustrated in Fig. 129: one end of the gut C is pulled through the soft palate and the end passed through a loop of silk (A) inserted on the right side; on pulling the loop the end C will be drawn through the right side. When silk is used the double reef knot as shown at the lower part of Fig. 129, and generally adopted by Fergusson, is a very good one.

With respect to paralyzing the muscles of the palate, I have in six cases followed a suggestion of Mr. Callender's ("Clin. Society Trans.," vol. i), and done it three or four days before I attempted to bring the edges of the fissure together. I have accomplished my end also by making two lateral incisions through the soft parts as indicated in Fig. 124, completely dividing the soft palate from its lateral attachments. In all these instances the two halves of the soft palate at once fell together, and

FIG. 128.

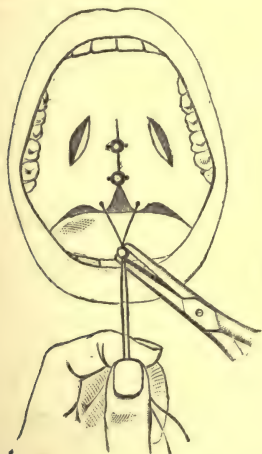
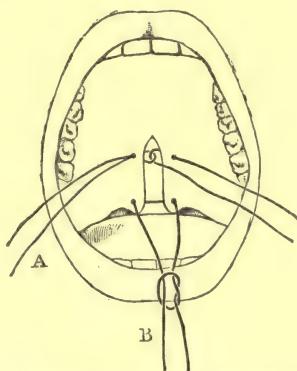


FIG. 129.



A. Avery's plan of passing sutures.
B. Fergusson's plan.

rendered the subsequent operation a simple and a rapid one. The stitches may be left in five or ten days, or even fourteen days, the amount of irritation they cause being the guide to their removal. When union has taken place, however, they can only act as irritants, and in this as in all plastic operations they should be removed as early as they can be with safety. During the process of repair the patient may take soft food freely, swallowing by itself in no ways tending to separate, but, on the contrary, to close the wound. Stimulants may be given if desirable. The operation should, however, only be undertaken in healthy patients; in the feeble it is almost sure to fail. After the operation the patient's friends must not be led to expect that an immediate change for the better will be traced in the voice, for such is never the case; indeed a long interval of time and a process of education is needed to acquire this result, although in many instances the improvement is very great. How far an operation in infancy tends in this direction is not yet proved, sufficient experience in these early operations not having been as yet acquired. Should a small orifice near the hard palate be left after the operation, there is no necessity to inter-

fere again, for it is a clinical fact that they have a strong tendency to contract, and the younger the patient the greater the probability of their complete closure.

Mr. Tait, however, believes that if the muco-periosteum of the hard palate be elevated with a raspatory from the semilune of the palate bone, the tendinous attachment of the tensor palati will be raised with it, and thus paralyzed; in this way doing away with the necessity of any such division of muscles as practiced by Pollock or Fergusson, and diminishing the risk of the pinhole orifice at the junction of the hard and soft palates. He advocates, moreover, two or more operations; the hard palate to be closed first and the soft subsequently after some months' interval.

Fissures of the Hard Palate.—These are to be treated on like principles to those of the soft, the great point of difference consisting in the separation of the soft parts with the periosteum from the bone. Langenbeck's instrument is the best—a kind of small hoe; with this, after making an incision down to the bone along the edge of the gum, he scrapes all the soft parts from the bone down to the free border of the fissure, the covering of the palate then hanging as a free curtain. Care is required in this proceeding not to tear or injure the soft parts, and more particularly the anterior and posterior portions where the vessels enter. The other steps of the operation are such as have been described.

When operative relief cannot be given in these cases or has failed, the patient must be handed over to an experienced dentist, for with a good obturator of gold or other material great comfort can be given, and even a velum may be supplied of india-rubber; on these points an article in "Holmes's Surgery," by my friend Mr. James Salter, may be consulted with advantage. Operative relief is, however, always superior to instrumental, as in the latter the patient is entirely dependent upon the mechanist, in the former he is independent.

Wounds of the Palate are met with in practice from patients falling with pointed instruments in their mouths, such as pipes, sticks, spoons, &c. Small wounds need no attention, they generally do well; lacerated wounds, dividing the velum, should be brought together by sutures; where they have been left and a separation ensues the edges may be subsequently pared and brought together as in fissured palate.

Perforations of the Hard Palate are generally due to the exfoliation of bone; no plastic operation is of use. The proper treatment of such a case is to close the aperture by an accurately fitting plate of metal or vulcanite attached to the teeth, and arching immediately below the palate, but making no pressure upon the edges of the hole itself. The effect of a plug is to enlarge the aperture by absorption. (Heath "On Diseases of the Jaws," 1868.)

Ulcerations of the Hard and Soft Palate.—These are very common as a result of syphilis; they appear as *superficial ulcerations* about the pillars of the fauces, and margins of the velum; they are often preceded by an erythematous redness; and then take on a sloughing action in cachectic subjects. They may appear also as *mucous patches* at any stage of syphilis, congenital or acquired, involving at the same time the tonsils, tongue, &c. They appear as slightly elevated spots covered with an ashy or yellowish membrane, beneath which some slight ulceration may be found; they are commonly associated with other symptoms. They are to be treated as part of a constitutional disease, such local treatment being applied as the aspect of the surface may demand. Local-astringents, as alum and borax, are as a rule of value, and nitrate of silver also when local stimulants are needed.

Strumous Ulceration of the Palate.—This is a distressing affection, the

ulcerative action being often so rapid as to destroy within a few days the whole fauces. It is mostly met with in the young and feeble. In other instances it is slower in its action, although equally destructive, gradually eating away all the soft tissues, even to the hard palate and pharynx. It is often mistaken for syphilitic disease, or *vice versa*. The history of the case alone will determine the point. Tonics and local stimulants are, as a rule, the requisite treatment; good food, of a liquid nutritious kind, being given in abundance. When gargles are difficult to use, carbolic acid lotion, Condry's fluid, or iodine lotion, a drachm of the tincture to a pint of water, may be scattered over the parts with the spray producer. In certain cases a powerful local caustic, such as nitric acid, applied with a glass brush, will tend to arrest the action. As a result of ulceration of the soft palate, it sometimes happens that the palate becomes completely adherent to the posterior part of the pharynx. In a case now under my observation there is only an opening the size of a crowquill between the pharynx and the nose. In another one a central fissure exists leading down to the œsophagus and upwards to the nose. In this case the patient experiences great difficulty in deglutition. He has to eat with the greatest caution, otherwise the food passes into the larynx. Cases are on record in which it has been found necessary to enlarge this opening, and even to open the trachea to maintain life; under such circumstances it is probably a wise maxim always to open the windpipe before any operative interference is undertaken to enlarge the pharyngeal opening.

Tumors of the Palate, or new growths, are rarely seen. I have met with several cases of warty wrowths, simple and malignant, and in "Guy's Reports," 1869, I have recorded an interesting case of myxoma, that covered the whole of the hard palate, which was cured by removal. The majority of cases of tumors that involve the palate spread from the gums or upper jaw.

Elongation of the uvula from inflammatory cedema is sometimes a very acute affection. It comes on rapidly at times, and gives rise to suffocative symptoms. I have seen a case in which the uvula became as thick as a finger, and rested on the tongue with its tip forwards. There is a drawing of it at Guy's; an incision into it, or many punctures, may give relief; but, as a rule, it is better to cut off the lower half of the organ. Elongation from other causes is far more common, and it is generally to be recognized by the peculiar hacking cough and husky voice to which it gives rise, the end of the uvula acting as a constant irritant to the epiglottis or glottis. Indeed, there is reason to believe that not a few of the cases of supposed laryngeal irritation are due to this cause. The removal of the lower half of the organ, by means of a long pair of forceps or scissors, rapidly gets rid of all the symptoms.

A Polypus composed of simple mucous membrane may grow from the uvula. I have removed one from its tip, and a second from the base. They give rise to symptoms identical with those of elongation. I have a case now under observation in which the polypus has so long a peduncle as to fall at times into the orifice of the larynx, and excite a violent spasmodic cough. The patient, a man, refuses to have it removed.

Tonsillitis.—As an acute affection this is known as *quinsy*. It is characterized by the rapid swelling of the part, acute pain, foul tongue, and fever. Within three days, or longer, suppuration may appear, and when suffocative symptoms make their appearance, the surgeon's interference may be required. At times life may be sacrificed by the want of surgical attention. Some years ago a case came before my notice where a child, two years of age, was suffocated from the bursting of a tonsillitic abscess.

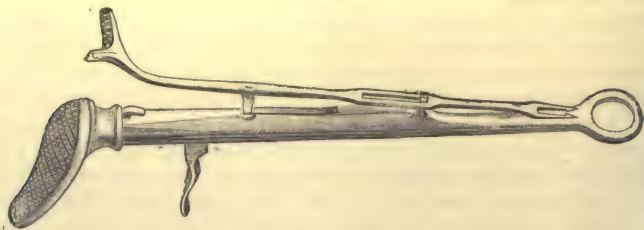
Great redness and rapid swelling of the organs are the chief local symptoms.

TREATMENT.—Fomentations externally, the inhalation of hot steam, and saline purgatives, are essential points of practice; in respect of drugs none seem to have so powerful an influence over the disease as guaiacum, an ounce of the mixture with some compound spirits of ammonia being the best form to give; when this can be given early suppuration rarely appears. When an abscess has formed, the sooner it is opened the better. The best way to do this is to cover a straight bistoury to within an inch of its point with lint, and having depressed the tongue with the finger, to introduce it into the swollen tissue, giving a free vent; care being taken not to direct the point of the knife outwards, but directly backwards. Should pus appear behind the pharynx it must be let out. Tonics, as quinine or iron, should then be given, with good food, and a speedy convalescence as a rule ensues.

Chronic Enlargement of the Tonsils.—This is frequently met with in feeble children as well as in adults that live in marshy and damp localities. It is often a sequel of the more acute inflammation, but as often as not it appears without any such cause; indeed, there is reason to believe that some of the cases of so-called chronic enlargement of the tonsils are due to new adenoid tonsillitic growths. On two occasions, when removing these enlarged organs, I have turned out of their beds distinct tumors the size of nuts imbedded in and surrounded by tonsillitic tissue; these were distinctly glandular, and under the microscope could not be distinguished from tonsil tissue. In both these cases the enlargement was unilateral. Bilateral increase is probably always due to hypertrophy or chronic inflammatory enlargement.

This enlargement gives rise to a peculiar nasal twang in speaking and to a most distressing snoring, the patient as a rule having a half-opened mouth night and day. It is commonly associated with irritable mucous membranes generally. I have seen it, in a child three and a half years old, so great as to prevent the deglutition of solid food, and it had lived for six months on liquid nourishment. Tonic treatment is essential in all these cases and *simple* nutritious diet. The bark and soda mixture is the best at first to soothe and give tone to the digestive apparatus, cod-liver oil, quinine and iron, being subsequently prescribed. When the organs are congested from inflammation the glycerin of tannic acid is a good application, and when simply enlarged a mixture of glycerin and the tincture of the perchloride of iron, in equal parts, or *Liq. Iodi* should be used. It is good also to give the patient some solid iodine to put into a perforated box to stand

FIG. 130.



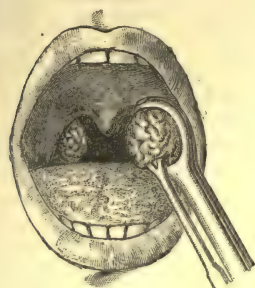
Guillotine prepared for use.

on a shelf in the day and sleeping rooms, the gradual evaporation of the iodine seeming to purify and iodize the air in a beneficial way.

When the glands are white and hard, all hopes of curing them by med-

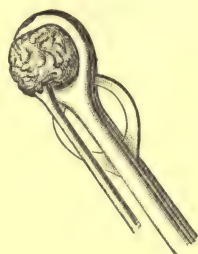
ical treatment have disappeared; excision is then the only sound treatment. The guillotine (Fig. 130) is probably the best instrument to employ when it is at hand, otherwise a pair of vulsellum forceps and a bistoury must be

FIG. 131.



Applied.

FIG. 132.



Operation on tonsil.

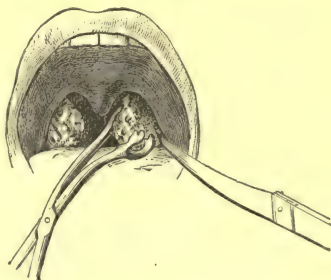
employed, guarding the base of the latter with lint or strapping to protect the lips (Fig. 133).

Calculus in the Tonsil.—In 1860 such a case came under my care. A man, *æt.* 38, after having suffered from enlargement of the right tonsil for a year and a half, expectorated a calculus the size of a nut, the expulsion of it having been preceded for three days by severe local pain and the sensation of something having given way in the parts immediately beforehand. When I saw him there was a distinct cavity in the tonsil. The stone was hard and ragged, and appeared to be made up of phosphatic salts, but the patient claimed the stone, and therefore it was not examined. Small calculi the size of mustard seeds are more common. They are supposed to be calcified tuberculous deposits. In Guy's Hosp. Mus. (Prep. 1677⁵⁰) there is a specimen analyzed by Dr. Babington; it consisted of phosphate of lime.

Cancer of the Tonsil.—This rapidly fatal affection is happily rare, and has not received much attention. It may appear as a primary or as a secondary affection, and in the encephaloid or fibrous form. The *former*, the more frequent and rapid in its course, destroys life mechanically by secondary glandular enlargement, and pharyngeal and laryngeal obstruction. The *latter* is seen mostly as an ulceration, and proves fatal by exhaustion.

This affection begins as an ordinary enlargement of the gland; it is, however, more rapid in its growth, and is mostly attended by early enlargement of the lymphatic glands at the angle of the jaw, and subsequently of those of the neck; when it ulcerates, the ulcer assumes the indurated jagged appearance of a cancerous sore, not unlike, however, the deep syphilitic sore from the breaking down of a gummy tumor. It has, however, a more indurated base and border than the syphilitic. It mostly attacks men of middle age, but not long ago I had under my care a sweep only seventeen years of age, with the hard form; and I have the records of three other cases in males, aged respectively 49, 62, and 65.

FIG. 133.



TREATMENT.—Palliative treatment is probably the best to adopt, although Dr. Cheever, of Boston, has proved to us that the tonsil may be successfully extirpated by external incision ("Boston Med. Surg. Journ.," 1871). Its removal from within seems almost out of all question, whether by caustics—Maisonnette's plan—the *écraseur*, or enucleation. I attempted the latter plan in one case with only partial success. The operation, however, prolonged life.

Dr. Cheever performed his operation through an incision made below the angle of the jaw of three and a half inches, along the anterior border of the sterno-mastoid muscle, with a second extending along the lower border of the jaw. The flaps were reflected, and a large gland enucleated. The dissection was continued, and the digastric, stylo-hyoid, and styloglossus muscles were divided, the fibres of the superior constrictor being removed by a director. The pharynx was opened. The finger of the operator was then swept round the diseased tonsillitic mass, which was enucleated. The hemorrhage was free, but not excessive; twelve ligatures were applied. A steady convalescence followed. "The facilities," adds Dr. Cheever, "with which the tonsil can be enucleated with the finger is surprising. This operation may probably be a justifiable and good one in those cases before the glands are too far involved." For more information upon this subject, reference may be made to the article, "Amygdales," No. 2, "Dictionnaire de Médecine," 1865, and to Poland's article, "Brit. and Foreign Review," April, 1872.

CHAPTER XXIX.

DISEASES OF THE GUMS, JAWS, ETC.

Epulis.—Under this term are included most of the tumors of the gums—hypertrophic, polypoid, or diffused—simple outgrowths from the gums, due to the irritation of a carious tooth or stump, papillary tumors, and fibrous, fibroplastic, myeloid, epithelial, and cancerous tumors. When connected with a carious tooth, the outgrowth is usually small and vascular, bleeding readily on manipulation; it is easily removed and permanently cured on the extraction of the offending tooth or stump.

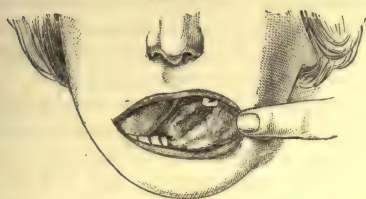
The fibrous, fibroplastic, and myeloid, or *true* epulis—for these elements enter in different proportions into all the benign forms of epulis—are always diseases of the periosteum or bone. They seem to spring from this tissue under all circumstances, and are rarely cured without its removal. They may appear as simple fleshy outgrowths of the gum about a tooth, and develop into a large mass of a firm or semi-elastic tissue. At a later stage this mass may ulcerate and break down.

The removal of the disease, and of the bone with which it is connected, is the only sound practice; a good pair of cutting pliers, which will nip off as much of the alveolar process as seems involved, being the best instrument to use, a small hand-saw having marked out vertically the limit of the incision. When the bone is not removed, a return of the disease is almost certain. Fig. 134 well illustrates the ordinary appearance of a fibrous epulis; Fig. 135 its growth from the bone.

A cancerous disease of the gums puts on precisely similar appearances to that of the fauces, face, or tongue, &c., an irregular, excavated, ulcer-

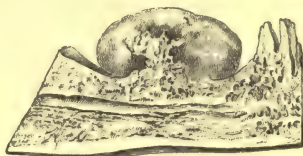
ating surface, discharging fetid pus, and associated with pain, and glandular enlargement marking its true nature. Most of the cases of cancerous epulis

FIG. 134.



Fibrous epulis from gum. Drawing, Guy's Hosp. Mus., 271¹⁰. Mr. Birkett's case.

FIG. 135.



Epulis springing from bone. Mr. Key's case.

are epithelial. The benign form of epulis is generally an affection of young life; the cancerous of the old and middle-aged.

Abscesses about the gums are very common; they are frequently the result of disease of the teeth. Dentists, however, tell us that these gum-boils rarely induce any disease of the bone; they sometimes, however, originate from it. When connected with a carious tooth, and of long standing, nothing but the removal of the tooth will cure the affection. When associated with disease, such as "necrosis," or death of the bone, the removal of the dead portion becomes a necessity.

Necrosis of the Jaws.—This is a common affection, as a consequence of one of the exanthemata, or some fever, and is now fairly recognized; it is more common in children than in adults. It appears as a rule on the decline of the fever, with pain and swelling about some portion of the gums, and rapidly passes on to suppuration and to death of the bone. The necrosis is, however, generally confined to the alveolus, in exceptional instances involving the body of the bone. Both jaws seem to be equally liable to the affection. In the Guy's Hosp. Reports for 1869 I have recorded a series of cases to illustrate these points. In one case narrated in detail, that of a woman, æt. 25, who had lost a large portion of her upper jaw after measles in infancy—the lower jaw had grown up to fill in the deficiency in the upper; it was nearly one inch higher in its vertical measurement on the right side than the left; it seemed, indeed, as if the lower jaw had grown upwards for want of the regulating influence of the natural pressure which the teeth of the upper jaw must exert upon the teeth of the lower when in contact with them. It is a pretty example of compensatory action in nature.

Necrosis of the jaws as a result of the phosphorus poison is now rarely seen, in consequence of the common phosphorus being less frequently employed than of old in the making of lucifer matches. Dr. Bristowe, in his report to the Privy Council in 1863, clearly showed that it is to its influence the disease is to be attributed, the *amorphous phosphorus* being harmless. The first notice of the affection in this country was by my colleague, Dr. Wilks, in the "Guy's Hosp. Rep.," 1846. The disease is an acute one in every sense. It may involve a part only or the whole of the upper or lower jaw, both jaws seeming to be equally liable to the affection; but in the majority of cases the teeth of the affected bone are more or less diseased or deficient, it being a rare thing to find the disease in subjects who have sound teeth, or in any who have a complete set. Some openings down to the bone, either through carious or deficient teeth, appear to be necessary to enable the phosphorus fumes to act upon the bone.

The disease begins in most part by a general aching of the teeth, rapid

suppuration and necrosis of the affected bone following. The constitutional symptoms are usually as severe as the local. Necrosis may also take place quite independently of any of the causes already alluded to; indeed, it is generally difficult to make out any true cause. It is found in both upper and lower jaws, an analysis of fifty consecutive cases telling me that nineteen were in the upper, twenty-nine in the lower, and two in both; controverting the assertion of Stanley, which has been repeated by others, that necrosis of the upper jaw is a rare affection. It may show itself at any period of life; I have seen it in an infant two weeks old, although it is more common in the young and middle-aged than in the old. It may attack any portion of the bones, and even the condyloid processes of the lower jaw may die and be removed, leaving a movable jaw, a new joint clearly forming. In the child, *æt.* 8, from whom I removed the bone, illustrated below,

FIG. 136.



Portion of lower jaw removed for necrosis from a child *æt.* 8, the movements of the jaw being subsequently perfectly regained.

the child could move the jaw as well as if the condyle had never been destroyed, and in the "*Guy's Hosp. Rep.*" for 1869 I recorded another case like it.

Necrosis of a bone is always preceded by symptoms of inflammation, such as swelling and pain, followed rapidly by suppuration, and the formation of sinuses leading down to the bone, which may be felt by a probe. A single sinus below the jaw or in the neighborhood may be due to the presence of a diseased tooth.

TREATMENT.—When dead bone can be made out to exist, either in the upper or lower jaw, there is but one form of practice which ought to be entertained, and that is its removal. It should be removed, also, with as little disturbance to the soft parts, or to the new bone-forming tissues, such as the periosteum, as possible. It should likewise be removed by the mouth. When this latter practice is impossible or impolitic, from any cause, the surgeon should take good care that his external incisions are made where they will be subsequently little seen.

In necrosis of the *upper* jaw the bone can always probably be removed by means of incisions made *beneath* the cheek. An incision *through* the cheek never seems necessary.

In necrosis of the *lower* jaw, where incisions through the integument are demanded, they should be made below its lower border. When the dead bone is fixed, or rather before it has been thrown off from its attachments, any operative interference must be condemned; any attempt at its removal can at least only be partially successful. Indeed, in the lower jaw, the result of the case may not be as favorable as it would otherwise have been, for there seems little room to doubt that the museles, acting upon the new bone before it has become consolidated, may alter its shape and produce deformity. Under these circumstances the surgeon should content himself with seeing that all pent-up pus has free vent, by making incisions through the gum, that the patient's mouth is kept as clean as possible by frequent washing, and that his general condition is maintained by means of tonic medicine and nutritious diet. When the necrosis is confined to the alveolus in which the temporary teeth are involved, great care should be taken that the parts beneath are not disturbed, and that the permanent teeth are not interfered with. Even when exposed they need not of necessity come away. In young patients, where much loss of bone has taken place, it seems desirable to have some artificial substitute, to prevent the occurrence

of such a compensatory growth as took place in the case quoted above. Where the antrum is exposed by exfoliation much may be done by the dentist to fill in the gap; thus some three years ago Mr. Salter very skillfully adapted a plate with teeth to the upper jaw of a woman, in whom the anterior wall of the antrum, with part of the alveolar process, had exfoliated. At times the fistulous opening takes place externally; thus, in 1864, I was called upon to treat a woman, æt. 34, who nine years previously had had extensive necrosis of the upper jaw, and, as a consequence, a fistulous opening the size of a sixpence below the right eye was left, communicating directly with the antrum. The soft parts were firmly connected with its margins, and the lower lid drawn down. I raised the integument from the bone, making free subcutaneous incisions, pared the edges of the flaps, and brought them together over the opening in the bone. Good union followed, and the deformity was removed.

Tumors of the Jaws.—Some of the most remarkable tumors of these bones are due to hypertrophy or hyperostosis, the lower jaw with other bones of the face and head being generally involved. Mr. Howship's well-known case of disease of the upper jaw, which is copied everywhere, is a case in point; but a better one is that of Mr. Bickersteth's, which was exhibited at the Pathological Society in 1866, and described with all minuteness in the "Transactions" of the year. The disease is usually symmetrical, and shows itself as a uniform enlargement of the bones involved, the upper jaws projecting as two large globular masses.

Cystic Disease of the Antrum.—This is a special affection, and is often connected with irregular dentition; how often is not yet determined.

Suppuration of the cavity is, doubtless, often due to an extension of inflammation from the teeth; it may be caused by a blow, or some other cause. It is known by severe local pain, extending over the face and forehead, local swelling, and extreme tenderness, the constitutional symptoms being often very severe. When pus has formed there may be rigors, and the abscess may burst either into the nose or into the mouth beneath the cheek, the antrum, under these circumstances, becoming much distended. In rare cases it may make its way through the cheek; a case I have lately seen took this course, an opening being subsequently found, on making an incision down into the bone beneath the cheek, into the antrum the size of a silver fourpence. In neglected instances the floor of the orbit may be displaced, and vision interfered with, or even destroyed. *Vide* Salter, "Med.-Chir. Trans.," 1863.

TREATMENT.—When suppuration has been made out to exist, the antrum must be opened, and should its anterior wall be expanded, an opening may be made into it without fear with a trocar or other sharp instrument at the most projecting point. The relief this operation gives is very signal. In a case that came under my care in a lady some years ago, it was instantaneous and permanent. When diseased teeth are present in the bone, they should all be tested by a sharp rap, and the most tender one removed. A jet of ether spray upon each tooth will prove a finer test than anything else, the cold searching out the slightest disease. It is never expedient to remove sound teeth unless some evidence exists of their sockets being diseased. In all these cases the cavity must be kept clean by syringing. A chronic abscess in the antrum may be so insidious in its formation as to induce the surgeon to believe that a tumor exists; indeed, Liston gives an instance in his "Practical Surgery" of such an error, in which removal by extirpation was attempted. In all tumors of the upper jaw the probability of the presence of a large cyst should never be forgotten.

Hydroids Antri is now a well-recognized affection. It is characterized by

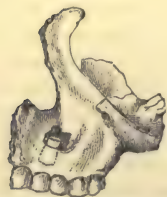
a gradual and generally painless expansion of the bone, and rarely produces other than mechanical symptoms; it encroaches on the nose, and causes obstruction; on the orbit and presses on the globe; on the mouth, and produces bulging of the palate; and on the cheek, so as to cause deformity; indeed, it is often for this that the patient is induced to seek advice. When the expansion is great the shell of bone may become so thin as to crackle like parchment under pressure. This sensation may be yielded by pressure upon its external or palatal surface. M. Giraaldès was the first to describe these cysts with clearness in 1853 (Montyon prize), although Mr. W. Adams had previously recognized them. *Vide* "St. Thomas's Hospital Museum Catalogue." The old surgeons looked upon this affection as the result of obstruction to the aperture between the nostril and antrum, the dilatation of the bone being due to retained mucus. This is now known to be an error, all recent pathology tending to indicate that it is a cystic disease of the mucous lining of the antrum, the affection showing itself as a single cyst or as a cystic degeneration of this tissue; Giraaldès regards these cysts as dilatations of the glandular follicles of the mucous membrane. The fluid contents of the cysts are always viscid; at times clear, but mostly blood-stained, containing cholesterin, occasionally purulent, but never pure mucus.

Dentigerous Cysts are clinically closely allied to those just described; pathologically they may differ; but there is no doubt that the cysts are connected with the teeth, which are in some cases fully developed, in others imperfectly so. They are found in both upper and lower jaws. Heath, in his excellent "Essay on the Jaws," 1868, tells us that cysts of small size, in connection with the fangs of permanent teeth, are frequently found on extraction, but give rise to no symptoms demanding surgical interference. Occasionally growing to a large size they produce absorption of the containing alveolus, and give rise to a prominent swelling. The disease is generally slow in its progress, and tolerably painless; by its pressure the cyst may cause absorption of the bone with which it is in contact, and a deep excavation. Paget relates such a case in his "Surgical Pathology" as a cyst near the gums, and I have now under observation a woman who had a tumor in her left cheek for years, which was opened, and some watery fluid came away. She applied to me for a bony projection of the cheek, which was clearly the edge of the alveolar process of the upper jaw, the bone above having been absorbed by the pressure of the cysts, thus causing a cup-like depression. She had had all her teeth removed at different times by dentists, under the impression that the disease was due to them.

Cysts connected with Undeveloped Teeth.—The *dentigerous cysts* are found in both jaws; they are almost always connected with the permanent teeth, rare cases being recorded in which the temporary are implicated.

In this affection the teeth fail in the cutting and remain within the jaw; the tooth, acting as a foreign body, sets up irritation, and either the cystic affection I am now considering or some solid growth. Thus in a boy *æt.* 6, that came under my care two years ago, a cystic enlargement of the jaw existed of three years' development; it encroached on the orbit, mouth, and cheek. I made an opening into the anterior wall of the cyst, making a window in the bone, and through this

FIG. 137.



Tooth as seen through opening in upper jaw.

FIG. 138.



Natural size of tooth when removed.

a tooth was visible with its crown upwards; it was an incisor, as seen in

the drawing. The tooth was removed and a good recovery ensued. I have recently, January, 1872, treated a similar case in a girl, *æt.* 17, sent to me by Mr. Salter, who had had her under observation for two years. The disease was in the right upper jaw, and the right canine tooth was deficient. I exposed the cavity and removed the tooth, which was growing in an abnormal direction upwards and inwards, a good recovery taking place. I saw my colleague Mr. Poland open one in the lower jaw and remove a tooth with success. Mr. Heath has collected many similar cases. It is well to remember that these dentigerous cysts, like other cysts of the jaws, may simulate solid tumors. When they occur in the lower jaw and expand the bone this error is very likely to take place. In all tumors, therefore, of the jaws that have a smooth or cystic outline it is well to make an exploratory puncture for the purpose of diagnosis. When the walls crackle from the thinness of the expanded cavity the diagnosis is simple.

TREATMENT.—The free opening of the cyst is the essential point of practice to observe in all these cystic diseases of the jaws, upper or lower, with the extraction of any tooth that may be present in the cyst. This may be done with a sharp pair of forceps, after a perforating wound has been made by a drill, gouge, or pointed instrument. To induce suppuration of the cysts it is a good practice to plug the cavity with lint. When the cavity is large it is a wise measure to take away a good portion of its wall. Removal of a bone for cystic disease is rarely needed. Before the pathology was understood, however, this malpractice was often perpetrated as our different museums too surely testify.

Dentigerous Tumors may likewise occur. In Fig. 139 is illustrated a case in which I removed the upper jaw of a child, *æt.* 8, for a nearly solid bony tumor of the jaw clearly originating in a malplaced tooth which was growing from the posterior part of the orbital plate of the bone; one or two cysts existed in the growth, enough to call it cystic. There was no possibility of making a diagnosis in this instance; such examples are, however, very rare.

Tumors of the Jaws.—These are of different kinds—simple and malignant; connected and unconnected with teeth. When in the antrum their dental origin should be suspected, but in both upper and lower jaws solid tumors of all kinds have been found with teeth as their centres.

Polypi of the Antrum—like those of the nose—are occasionally met with, and they mostly show themselves as projections into and through the nostril, the tumor making its way through the nasal wall of the antrum, and at the same time generally expanding its facial wall. I have seen three well-marked cases of this kind; in one the whole mass was removed through the nostril, which was laid open, and turned back. In the second the cheek was reflected outwards at the same time and a large opening made into the antrum allowing the surgeon to scoop it out. Both occurred in the practice of Mr. Cock, and a third, similar to the last, occurred in my own practice. Weber, quoted by Heath, tells us that in an analysis of 307 cases of tumor of the upper jaw, rather more than one-third of the whole number may be set down as sarcomatous simple tumors, one-third as osseous, and less than one-third cancerous, the myeloid being included in one of these groups. These may grow also from any part of the bone or periosteum. When they originate in the antrum they expand its cavity as in the cystic diseases, and cause a bulging of one or more of its walls. When they spring from a surface or plate the tumor will project from it, leaving the other sur-

Fig. 139.



faces unaffected. The fibrous in all its forms and the osseous are usually of slow growth; they are often painless, and trouble only from their size. The fibro-plastic, myeloid, and cancerous are of more rapid growth. The fibrous or fibro-plastic are usually periosteal growths, the osseous, myeloid, and cancerous endosteal. The cartilaginous are very variable in their progress, at times very slow and at others rapid; they are mostly of the mixed kind, fibre tissue largely predominating in tumors of slow formation; they frequently involve many bones. Sir J. Paget ("Surgical Path.") states that the only case on record of enchondroma of the upper jaw alone was removed by Mr. Morgan—late of Guy's—from a man *æt.* 24; the tumor was of the right maxilla and was of nine years' growth. The patient survived the operation seven years. The two drawings below illustrate the case; the first was taken before Mr. Morgan's operation, the second after the patient's death. Dr. Heyfelder of Munich, however, says, he found eight such cases out of 450 of disease of the upper jaw.

FIG. 140.

Before operation. Model, Guy's Hosp. Mus. 38¹⁰.

FIG. 141.

After death. Model, Guy's Hosp. Mus. 38¹².

TREATMENT.—All solid tumors of the upper jaw are to be extirpated, but no more of the bone should be removed than is sufficient to allow this operation to be performed. Thus, when the disease springs and projects from the facial surface of the bone, the tumor, with the facial plate alone, needs to be excised. When the alveolar process is alone implicated the other portions of the bone should not be touched. Where possible the palate plate should be preserved, and to touch the orbital plate without an absolute necessity is bad surgery. When the whole bone is involved in the disease it must be taken away, but such cases are exceptional. In many cases where the disease originates in the antrum, a partial removal of the bone will suffice if the surgeon will at first only lay open the cavity and find out the base of the growth. For perforating the antrum for the purpose of exploring Sir W. Fergusson recommends an ordinary carpenter's gimlet. To Sir W. Fergusson is undoubtedly due the establishment of this rule in practice, and it is one that all surgeons should strive to follow.

Operation for the Removal of Part or the Whole of the Upper Jaw. The incision now almost universally adopted for the removal of tumors from the upper jaw is that of Sir W. Fergusson; by it all the necessary room is given to remove even the largest growth; the facial nerve and artery are divided where by their size they are of small consequence, and

the scars are so placed as to become hardly noticeable. In tumors of *moderate* size the incision is simple, carried through the median line of the lip into the nostril, the raising of the nostril and retraction of the cheek outwards giving abundant room. When more room is required the operator may extend his incision round the ala and up the side of the nose towards the inner canthus, and should this be still insufficient a third incision may be made from the termination of the second, along the lower border of the orbit.

All these incisions are indicated in the drawings below. Fig. 142 was taken from a man æt. 35, from whom I removed an osteochondroma, of twelve years' duration, involving the facial and palate plates of the superior maxilla. The dark line indicates the incision made; the dotted extra line the one that may be required in exceptional instances. Fig. 143 illustrates Gensoul's and Liston's method.

In some cases the ala of the nose alone may be turned up. I removed a fibrous tumor growing from the nasal process of the superior maxilla by this incision, and found plenty of room. The incision having been made, and integument reflected

sufficiently to expose the tumor, all bleeding is to be stopped by ligature or torsion. Assuming the whole bone is to be taken away, the incisor tooth of the affected side must be removed, and the palate plate of the upper jaw, with the alveolus, divided with a fine saw (Fig. 144) introduced into the nostril. The malar process of the maxillary bone is then to be partially sawn through, as well as the nasal process of the superior maxilla, their complete section being made with bone forceps. The tumor is then to be seized, the Lion forceps (Fig. 145) being employed, and the whole wrenched off, bone forceps and scissors being employed to complete any section that requires completion. The infra-orbital nerve should be divided with scissors, and the soft palate left as little injured as possible. Should any portions of the disease be left they may now be removed. All bleeding vessels are to be treated by ligature, torsion, actual cautery, or styptics, and the parts carefully brought together with interrupted sutures.

When the disease, says Heath, is of less amount, and the orbital plate is not involved, this should be preserved by carrying a saw horizontally below it; and if the palate is not involved this may be advantageously kept intact by making a similar cut immediately above it. Sir W. Fergusson, indeed, advises that the disease should be cleared out from the centre towards the circumference, so as not to remove healthy structures unnecessarily,

FIG. 142.

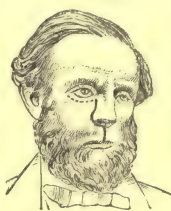
Fergusson's
incision.

FIG. 143.

The dotted line a, Gen-
soul's incision; b, Lizar's
and Liston's.

FIG. 144.



FIG. 145.



and this may be readily accomplished by means of the many forms of curved bone forceps with which surgeons are now familiar, aided by the gouge.

Tumors of the Lower Jaw grow to enormous dimensions, and pathologi-

cally they are very similar to those of the upper. The fibrous in one of its

FIG. 146.



Mr. Heath's case.

forms is probably the most common, the periosteal tumor being more frequent than the endosteal; the latter may occupy the dental canal as illustrated by a case of Mr. Cock's (Guy's Hosp. Mus. 1091^{vs}), in which the dental nerve passed through the tumor. The periosteal growth is often an epulis; a good example is represented in Fig. 134. One of the largest fibro-cellular tumors of the bone on record occurred in Mr. Heath's practice; it is here illustrated with his permission, Fig. 146; it was removed from a man æt. 32, and the disease was of eleven years' growth. The tumor weighed 4 lb. 6 oz.; the man died on the sixth day from exhaustion.

Fibro-cystic tumors of the lower jaw are very common, and they have the same clinical history and aspect as the cystic tumors to which attention has been directed. The most beautiful example on record is one that was removed by the late Dr. Hutton of the Richmond Hospital, Dublin, and is illustrated in Heath's book; it was made up of cysts; it was of nine years' growth, in a young woman only 20. A more remarkable case still, however, was operated upon by Mr. Key in 1841, in a boy æt. 13 (Figs. 147, 148); the tumor was

FIG. 147.

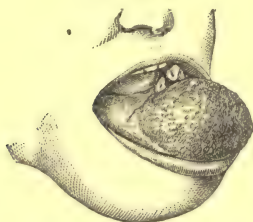
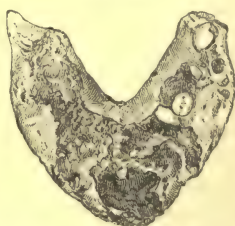
Guy's Hosp. Mus. Drawing 4th. Key's case, during life.

FIG. 148.

Guy's Hosp. Mus., 1090⁹⁰. Key's case. Tumor after removal.

of two years' growth and painless; Mr. Key removed the whole by sawing through it just below the angle on each side; a good recovery ensued.

Cartilaginous Growths are not very common; they occur in early life and are as already stated periosteal and endosteal. A fine example of the latter is to be seen in Prep. 1091¹⁵ and ¹⁶, Guy's Hosp. Mus., which Mr. Key removed in 1846, from a woman æt. 29, in whom the disease had been coming for nine years. In the preparation the fibro-cartilaginous substance is seen to be placed between the plates of bone of the jaw, the teeth being in the middle of the new growth. The periosteal tumor grows to a very large size.

Osseous Tumors are sometimes the result of ossified enchondroma. In St. Thomas's Museum is a specimen of this kind which was removed by Mr. Cline. Bone may, however, occur as an independent growth in the form of cancellated or ivory exostosis, which may sometimes grow to a large size.

Cancerous Tumors are usually endosteal, and many are the cases on record of the affection; they are met with in children and adults, and are

rarely of the hard kind of cancer. They are of rapid growth and soon break down, involving skin and all adjacent parts in the disease; indeed, any rapid growth about the lower or the upper jaw should be suspected as being cancerous. Almost all benign tumors are of slow growth.

TREATMENT.—Tumors of the lower jaw, as of the upper, are to be treated by excision, and as a large operation it is most successful. Thus, Heath says Mr. Cusack removed large portions in seven cases, with only one fatal result; and Dupuytren operated in twenty, with only one death. Sir W. Fergusson also tells us that his success has been very great; Liston's success is well known.

Small tumors of the jaw, and particularly of the alveolus, may be removed from the mouth with good cutting forceps, as may also many tumors involving the central portion of bone. Mr. Maunder, of the London Hospital, has recently done this operation with success. Should more room be required to manipulate in the mouth, an incision may be made outwards or downwards at the angle, and to facilitate the division of the jawbone a horizontal incision along the chin, and the dissection of the soft parts off the bone, will allow of the application of the saw.

When a large tumor has to be removed, it may be readily exposed by a curved incision carried along the posterior surface of the tumor from above the angle of the jaw to the median line, turning the soft parts back. In doing this the facial artery will be divided, and it should be at once secured at both ends by torsion; the knife, says Fergusson, may be so lightly carried over the artery that it need not be divided till the flap is being raised, thus saving blood. The labial orifice rarely need be divided; the incision should be stopped short of this margin. The tumor having been exposed, its surface must be well examined, with the view of the removal of the growth, by cutting away the external plate of bone which covers it in; this may be done by means of the gouge and bone forceps; indeed, this step may be looked upon as a wise one under most circumstances, particularly in doubtful cases, for a large number of tumors of the jaw, particularly the cysts, may be scooped out, and a good recovery ensue. Should the tumor and jaw have to be excised a tooth must be extracted in front, where the bone is to be divided and a small saw applied; the bone is then to be grasped with the Lion forceps and drawn outwards, the surgeon carefully dividing all the soft parts that hold it in position on its inner surface, keeping the knife *close to the bone*; when the disease stops at the angle the saw and forceps are again to be applied and the tumor removed. Where disarticulation is required on account of the extension of the disease, the jaw must be forcibly depressed so as to bring the coronoid process within reach, and allow of the division of the insertion of the temporal muscle. The condyle may then be twisted out, the knife dividing cautiously such ligamentous fibres as are put on the stretch. Fergusson says that in doing this he has found the condyle actually separated from the periosteum on its inner side, thus facilitating its removal. When the tumor is so large as to be wedged in and prevent this mode of dislocation, the best plan is to re-apply the saw and cut off the tumor as high as may be, and subsequently to remove the remaining portion of the jaw. When the central portion of the lower jaw is removed, there is danger of the tongue falling back and causing suffocation; to prevent this a ligature may be passed through the tip of the tongue and held, its end being on the completion of the operation fastened to the wound, and divided on the second or third day.

After the operation all arterial bleeding is to be stopped, a stream of cold water over the parts arresting any oozing, and the edges of the wound

are brought together by interrupted sutures. Convalescence is generally rapid, and recovery complete; the deformity following being so slight as not to be observed in many cases; the interval being filled in with dense fibre tissue. Bone is never reproduced, but the tissues soon become firm enough to bear the support of artificial teeth.

The half sitting position is probably the best in all these operations on the jaws; chloroform may be given without fear. For more detail connected with this subject the reader may refer to Heath's admirable "Monograph on the Jaws;" Fergusson's "Surgery;" Liston's paper, "Med.-Chir. Trans.," vol. xx, and his "Pract. Surgery."

Disease of the Temporo-maxillary Articulation is rarely met with, indeed, more rarely than disease of any joint in the body. I have seen one example of it in a woman, æt. 34, who had had it for nine years, suppuration having existed for six. Several sinuses leading down to the joint were present, and the jaw was nearly fixed. Dead bone appeared to be present. The patient refused to have any surgical interference. In Guy's Hospital Museum there is also a splendid specimen, No. 1070, of complete synostosis of the articulation.

The cases already quoted of necrosis of the condyloid process of the lower jaw, and recovery with a sound joint, may here be referred to.

Closure of the Jaws may be caused by some spasmodic condition of the muscles of the jaw secondary to disease of the teeth, or the cutting of the wisdom teeth; in the latter case the mouth must be forced open, under chloroform, by means of the screw gag or wedges, and the tooth removed, or, what is better, room made for it to come forward by the extraction of a neighboring molar. It may likewise be caused by the contraction of cicatrices either within or without the mouth, or as indicated above by ankylosis. Dr. S. Gross, in his "System of Surgery," tells us that the former causes are the most common, and he attributes the majority to the evil practice of giving calomel to salivation. In rarer cases the immobility is occasioned by an osseous bridge extending from the lower jaw to the temporal bone, this condition being generally associated with chronic articular arthritis. However induced, writes Gross, the effect is not only inconvenient, seriously interfering with mastication and articulation, but it is often followed, especially if it occur early in life, by a stunted development of the jaw, exhibiting itself in marked shortening of the chin, and in an oblique direction of the front teeth.

TREATMENT.—Where the cause is in the joint, and cannot be removed, as can dead bone, the surgeon may attempt to break up the adhesions by forcibly opening the mouth under chloroform, or divide the bone below the joint. When due to cicatrices and nodular plastic matter, little good has ever been derived from their division. Esmarek, of Kiel, in a paper "On the Treatment of Closure of the Jaws from Cicatrices, 1860," has, however, described an operation for the formation of a new joint in these cases, his operation consisting in a removal of a piece of the lower jaw. Mr. Henry and Mr. Heath in this country have both put into practice Esmarek's operation, and the success has been enough to indicate its great value. It must be mentioned that about the same year Rizzoli, of Bologna, performed a somewhat similar operation to Esmarek's, dividing the jaw but not removing any portion.

Operation.—This may readily be done by making an incision along the lower border of the jaw, in front of the masseter, and raising the integument, completing the operation by removing a wedge of bone, measuring about an inch above and half below, with a hand or chain saw. Where

only one side of the jaw is affected, it is without doubt the best operation to be performed, the patients recovering their masticatory power in two or three weeks.

Deformities of the Jaws are sometimes seen as a consequence of some disease of the tongue, such as hypertrophy; the mechanical pressure of tumors during their growth; the evil influences of cicatrices, more particularly about the neck and mouth, and other causes. For these surgery may often do much, and when this fails the dentist can give relief. I have seen the upper jaw in two cases of torticollis nearly one inch less in its vertical diameter than on the opposite side, and I have already alluded to a case where the lower jaw was nearly an inch higher than natural, to make up for a deficiency in the teeth of the upper jaw which had existed from childhood.

Dislocation of the Jaw.—This may involve one or both condyles, two out of every three cases being bilateral. It may be caused by direct violence upon the jaw, but more frequently by yawning. Sir A. Cooper tells of a case in a child where it was produced by the forcible introduction of an apple into the mouth, and dentists know of its being produced by the extraction of a tooth.

In the *double* dislocation the mouth is widely open, the jaw fixed and projecting, the lips separated, and, as a consequence, speech is very difficult. Deglutition is much interfered with, and the saliva flows from the open mouth. In front of the ear a marked hollow will be perceptible, and *above* the zygoma in the temporal fossa, an undue prominence (Fig. 149). Adams, of Dublin ("Dub. Quart. Journ. Med. Science," vol. i), first noticed these symptoms, and Dr. R. W. Smith ("Fractures," 1854) believes them to be caused by the "displacement and stretching of the fibres of the temporal muscle on the upper surface of the condyle."

In the *single* dislocation the chin is oblique, but usually directed towards the *sound* side instead of towards the *injured* side, as in fracture of the neck of the bone. In exceptional cases, however, this is not to be observed. The other symptoms are similar to those of double dislocation, the hollow in front of the ear being the most characteristic one.

Congenital Dislocations have been described by Smith, Guerin, Langenbeck, and Canton. Sir A. Cooper has also drawn attention to *subluxation*, in which he assumed that the condyle of the jaw slipped in front of the interarticular fibro-cartilage. It is probably a partial dislocation forwards; it is caused and characterized by the same conditions as the cases of dislocation.

TREATMENT.—Partial dislocations, or those described as subluxations, are usually reduced by the patients themselves, by some little lateral movement of the jaw or by gentle pressure upon the chin. Cases of complete dislocation have likewise been similarly reduced; more frequently, however, the surgeon's aid is demanded. The patient should be placed in a chair with his head supported, and the surgeon should stand in front. The operator, having well protected his thumbs with a towel or lint, may then introduce them into the mouth, and with the thumbs upon the last molar teeth he should firmly grasp the jaw. Pressure should then be made upon the teeth downwards and backwards so as to depress the condyles from their false position, at the next moment elevating the chin with the outer fingers;

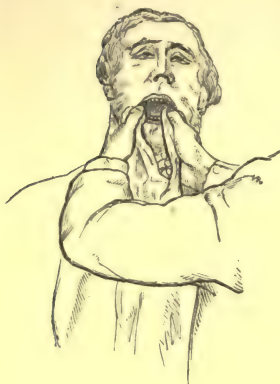
FIG. 149.



Cooper's case.
"London Hosp. Rep.,"
1864.

by these means reduction is readily effected (Fig. 150); some surgeons prefer using a piece of wood or the handle of a fork to depress the jaws. When strong leverage is required, as in old cases, Stromeyer's forceps may be employed. It is well to reduce both sides together; old standing dislocations may be thus reduced. Mr. Morley reduced one after thirty-five days; Spät after fifty-eight; Demarquay after eighty-three, and Donovan one after ninety-eight (Heath).

FIG. 150.



Fractures of the Jaws.—When the *upper jaw* is broken it is generally from direct violence, and when the “Key” was employed for the extraction of teeth, a fracture of the alveolus was far too common. In severe injuries much displacement may take place; hemorrhage is a very common consequence of such an injury, and indeed cases are on record where the internal maxillary artery was ruptured, and a fatal result took place. At times the infraorbital nerve or its branches are injured, when some loss of sensation in the cheek will be produced. I have known emphysema of the cheek to follow such an injury, and have seen subconjunctival hemorrhage indicate it. One of the worst cases of fracture of the upper jaw I have seen occurred at Hoxton Home from the direct blow of a lunatic's fist. The whole of the alveolar process of the right upper jaw was broken off, and the lower jaw fractured in two places.

TREATMENT.—Where *no* displacement has taken place little treatment is called for; the parts are to be left alone and natural processes will effect a cure. When *displacement* exists and can be remedied by manipulation such means should be applied, some slight retentive bandage with or without a pad being employed to keep the parts in position; when the palate plate is much interfered with and displaced, the dentist's aid may be called into requisition, a gold plate well adapted to the parts tending to keep the fragments together; *vide* Salter, “Lancet, 1860.” Hemorrhage, as a rule, can be arrested by the application of ice or styptics. When the soft parts are injured and bleeding takes place from them the vessel should be secured. When the bone is comminuted there is no need for the removal of fragments; Malgaigne laid this down as a law, and all surgeons now follow it, while Hamilton asserts that owing to the extreme vascularity of the bones composing the upper jaw, the fragments have been found to unite after the most severe gunshot injuries. In rare cases of separation of the maxillæ, says Heath, a spring passing behind the head and making pressure upon the maxillæ after the manner of Hainsby's harelip apparatus might be advantageously employed.

Fractures of the Lower Jaw, like the upper, are as a rule the result of direct violence. Those produced by gunshot injuries are at times most severe. They are almost always compound, that is, towards the mouth, the gum tissue readily giving way. The body of the bone is more frequently broken than any other part, although the ramus and neck of the jaw may be fractured. The line of fracture is generally oblique, and is very commonly near the canine tooth. Double fractures are very common, eleven out of twenty-four cases recorded by Hamilton being of this nature. Comminuted fractures are more rare. A case recently came under the

care of Mr. Poland at Guy's, in which the jaw was broken in five places by the kick of a horse. The symptoms are generally very clear, crepitus being often felt by the patient in attempting to move the jaw, and readily made out by the surgeon; the irregularity of the teeth is a very characteristic symptom, and the care of the patient to hold the parts in position with his inability to speak is typical. Should any doubt exist the mobility of the broken bones will disperse it; great displacement sometimes complicates the case, the position and the line of fracture determining this point; an oblique fracture near the insertion of a large muscle, as the masseter, necessarily showing a tendency to override.

In double fracture of the body of the bone this displacement is usually very marked, the muscles connecting the lower jaw with the hyoid bone drawing the lower portion down. In some cases this displacement cannot be completely remedied.

Fractures of the Neck of the Jaw are always the result of direct violence, and are not very readily made out; pain aggravated by any attempt to move the jaw is a constant symptom, and crepitus perceived by the patient. "The condyle," says Heath, "is drawn inwards and forwards by the pterygoideus externus, as can be ascertained by passing the finger into the mouth, and the jawbone is apt to become slightly displaced, so that the chin is turned towards the affected side, and not from it, as is the case in dislocation." I have had recently under care a man, æt. 35, who has had a fracture of both sides of the jaw, just below the condyles, with fracture of the symphysis; it was produced by a severe blow upon the jaw below the chin, and from the displacement that followed the house surgeon thought it was a case of double dislocation; on attempting to reduce it, however, it went in without the characteristic snap of dislocation. Some necrosis followed at the seat of each fracture, and from both sides portions of the neck or the condyles were removed. He has recovered with good movement and a good jaw.

Fracture of the Coronoid Process is very rare; Sanson says they never unite.

TREATMENT.—When the bones can be brought into apposition the treatment may be described as simple; where difficulties are met with in reducing the fracture the treatment is most difficult and uncertain. In an ordinary case of fracture of the jaw, where no displacement, or very little, exists, the common four-tailed bandage, a yard long, with a slit in the chin

FIG. 151.



FIG. 152.



piece of about four inches, made and applied as illustrated in Fig. 151, is all that is required for temporary purposes, but for permanent treatment it

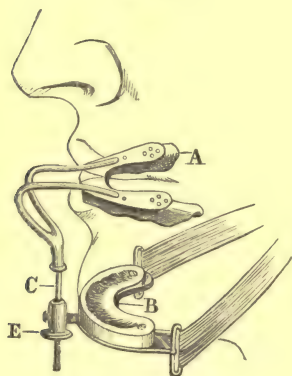
is well to mould on a splint of gutta-percha, made according to the shape given below (B), and applied as seen in Fig. 152, A.

When healthy teeth are present at the line of fracture they may be fastened together with silk or wire, but this practice need not be followed under other circumstances.

When difficulties are felt in the adjustment, as in double fracture, where the chin is much drawn down, a good pad may be firmly tied under the chin, or a block of wood adjusted. In one case I fixed a plaster cast, holding the jaw well in position by means of a piece of linen during the setting of the plaster. But in these cases the surgeon's ingenuity is often taxed to the utmost to meet the wants of the individual case.

Some surgeons have suggested that the bones should be fastened together by sutures when all other means fail, and Mr. Thomas, of Liverpool, has published two good cases to illustrate the practice ("Lancet," 1867). In

FIG. 153.



A. Metal mould for teeth.
C. Movable bar, with screw-piece (E), to fix tooth-mould to chin-piece (B).

the case of comminuted fracture already alluded to, this practice was followed by the best result; two or three wire sutures were applied. Others advise the use of wedges of cork, so adjusted between the teeth as to maintain the jaw in its right line. Hamilton speaks highly of gutta-percha moulded to the teeth and gums within the mouth, and Tomes has invented a silver cap to fit the teeth for some distance on each side of the fracture. Barrett carries out the same idea in vulcanite. Berkeley Hill's modification of Lonsdale's apparatus is probably as good as any (Fig. 153). Numerous other suggestions have been made, and in Heath's work, "On the Jaws," every detail will be found, but their very number proves the difficulties the surgeon has to contend with, and the ingenuity that is required to treat a difficult case. Any means that can keep the bones in position must be looked upon with favor,

and the simpler these are the better.

These cases as a rule do very well, whether simple, comminuted, or compound, within or without the mouth.

CHAPTER XXX.

AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

Inflammation and Suppuration of the Pharynx is not seldom met with in the feeble and cachectic subject; it comes on with general and local symptoms, not unlike those of quinsy; indeed both affections are often associated. Pain and difficulty in swallowing are the chief local symptoms, and fever with constitutional disturbance the general.

When **abscess** occurs it may be the result of an acute or chronic inflammation of the part; it shows itself by a bulging or projection of the mucous covering of the pharynx. The abscess at times is so large as to interfere

with if not prevent deglutition, and respiration may be even rendered difficult. When these conditions exist the abscess must be opened, a straight bistoury, protected up to the point by a piece of lint or strapping, being the best instrument to employ. An instrument called a pharyngotome has been devised for the purpose, and it answers well, but the bistoury is to be preferred. The surgeon must remember, however, that a post-pharyngeal abscess may be due to disease of the vertebræ, or of the base of the skull, but these cases are generally chronic. Tonics are almost always called for in these cases, as quinine, iron, or the mineral acids. Steaming the throat gives great comfort, as well as warm external applications. Nutritious food should always be allowed.

Tumors of the Pharynx may also so press the mucous membrane forward as to give rise to the external appearances of a chronic abscess. Cancerous tumors are very prone to do this. One of the most marked cases I have ever seen turned out to be a syphilitic gummatous tumor; it was so large as to make me suspect its cancerous nature, but on investigation it was clearly syphilitic, and was cured by ten-grain doses of the iodide of potassium in bark.

The cancerous tumors generally commence in the upper part of the pharynx, and cause obstruction of the posterior nares, gradually coming downwards and simulating a pharyngeal polypus. Two such cases have been under my care in young people, and both died. It was a question in both of them whether the disease was not originally in the tonsil, but it appeared to have commenced above the gland.

Dysphagia may be the result of want of power in the pharyngeal muscles or of œsophageal *ulceration* or obstruction. In the former class of cases the condition may be due to a paralysis of the muscles of the part from cerebral causes, to hysteria, or to diphtheria; for under all these circumstances there may be a more or less complete loss of power in the act of swallowing, food or fluid passing into the larynx and producing choking, or into the nose. After the operation of tracheotomy for croup, or other laryngeal cause, the want of adaptive power in the muscles of deglutition is also seen, liquid food at times travelling down the larynx and appearing at the external tracheal wound.

Laryngeal and pharyngeal tumors, and tumors about the base of the tongue, may produce the same symptoms.

When due to œsophageal obstruction dysphagia may arise from stricture of the tube itself—spasmodic or organic, the latter being caused by cancerous, syphilitic, or simple ulceration. It may be caused by pressure from without, whether from some thoracic, cervical, or aneurismal tumor, or from the presence of a foreign body in the tube. It will be thus seen that dysphagia is only a symptom. It is caused by numberless conditions, and cannot be treated till its cause is known. To make out the cause of the dysphagia is consequently most important, and this should always be done by eliminating one by one every possible cause.

Stricture of the Œsophagus as a rule takes place at its upper end, behind the cricoid cartilage, although it may occur at other parts. It may be *spasmodic* or hysterical, but more frequently it is associated with some kind of *ulcerative* action, simple, syphilitic, or cancerous, at times being *cicatricial*, the result of a former injury, such as the swallowing of a corrosive fluid, or other cause. It is a great question whether a simple fibrous stricture of the œsophagus, such as is found in the urethra, ever takes place. *Thoracic aneurism* is capable of producing every symptom of this affection.

Spasmodic or Hysterical Stricture is usually met with in the young,

but it may be found at all ages. Paget has described it as a kind of stammering of the muscles. It is probably always associated with some local irritation, some follicular inflammation or ulceration. This may have originated by itself, or been started by an injury, such as a scratch from the passage of a hard or sharp body; it is, moreover, usually associated with some dysphagia, some difficulty in using the muscles of deglutition as much as difficulty in passing the food on. The dysphagia is likewise intermittent and uncertain; give the patient food to eat or fluid to drink to test her power, she will tell you it is impossible for her to do what you want, and should she try she will to a certainty half choke. Yet at other times, when otherwise engaged, she will take food. Should a probang be used to examine the part its introduction will be violently opposed by the pharyngeal muscles, yet by a little steady pressure all obstruction will be overcome.

Œsophageal Obstruction.—When a patient complains of difficulty in swallowing, or rather of difficulty in passing food onwards down the Œsophagus after the act of swallowing has been performed, with its subsequent return into the mouth, the surgeon should always think of thoracic aneurism as a probable cause, then of cancer of some portion of the tube, and, lastly, of some ulcerative action; he should also always inquire into the history of the case, and satisfy himself that in no previous period has the patient sustained any local injury from the swallowing of any boiling water or corrosive fluid. Should the last cause be eliminated, and a careful examination of the chest and other modes of investigation get rid of the question of aneurism, the one of cancer becomes the most important, for there is little doubt that in the majority of cases of organic stricture of the Œsophagus, cancer is the cause. In the early stage of the affection the diagnosis is difficult; indeed, at this stage the surgeon is seldom consulted, for as long as solid food passes, the patient is hardly aware of any obstruction existing, the habit of swallowing small portions growing so gradually. An attack of spasm is perhaps the first symptom that attracts notice, this spasm completely closing the canal, and causing *regurgitation* of the food.

At this period of the disease the surgeon will probably be able to pass a probang, although it may be a small one. As the disease progresses some signs of ulcerative action may appear, such as the presence of some discharge of pus or blood, this usually coming up with the regurgitated food; when this occurs there is no better indication of the presence of ulcerative action. Should the patient be middle-aged, the time when cancer may be expected, the probabilities of the disease being of such a nature are very strong. Should there be any local thickening behind the larynx, or glandular enlargement, the probabilities are enhanced.

On the other hand, when the patient is a young adult, and a history of syphilis exists, its syphilitic nature is rendered probable; for simple ulceration or syphilitic ulceration of the Œsophagus is sufficient by itself to cause complete Œsophageal obstruction, simulating stricture, the mere mechanical obstruction being a strong element, but the spasmodic contraction of the tube is a stronger one in bringing about this result. This fact was very powerfully brought before me in a case I had at Guy's, with Dr. Habershon, some years ago. The patient, æt. 48, was dying from starvation from inability to swallow, on account of Œsophageal disease, and for this I performed the operation of gastrotomy. The man lived six days afterwards, and died of pneumonia. After death nearly a complete ring of ulceration was found at the upper part of the Œsophagus, and this had caused all his symptoms. Its syphilitic nature could not be decided, although the man gave a history of having had the disease twenty years previously. The

repair at the seat of operation was most complete, the stomach and integuments having firmly united. No peritonitis existed.

I recently saw, in consultation with Mr. Pink, of Greenwich, and Dr. Wilks, a case of complete œsophageal obstruction which we all believed to be cancerous, but which so far improved under the expectant treatment as to allow of the passage of well-minced food with comparative comfort; some months later, however, complete dysphagia returned, and the man died, a direct communication having taken place between the œsophagus and the respiratory tract from extension of the cancerous ulceration. Had a bougie been passed in this case a fatal result would probably have taken place as a consequence.

As the disease progresses other symptoms will appear, the ulcer eating its way into the larynx or trachea, when it soon proves fatal. It is from this fact that the surgeon should always be very chary in passing any bougie down the œsophagus, for when ulceration has taken place he will be very liable to do harm, even to causing perforation of the ulcer into the air-passages, or even the pleura.

TREATMENT.—Assuming the pathology of stricture of the œsophagus to be correct, the treatment by dilatation, *except in the cicatricial form*, is not only useless, but dangerous; when it is due to ulceration, cancerous, or otherwise, the irritation of a bougie must do harm, and cannot do good; and where it is caused by the presence of a cancerous or an epithelial tumor, the passage of an instrument is likely to hasten its breaking up and prove injurious. In the cicatricial, that is, which has followed upon some local injury, such as that produced by an irritant fluid, there is good reason to believe that dilatation is of great value, and if such treatment does not cure the disease, which it can hardly do, it will at least prolong life. A bougie as large as can be passed should be introduced daily, and retained as long as possible. The patient must take, as long as he can, nutritious food; solids finely minced, and fluid when this is impossible. Milk can often be taken when other food is refused. Beef tea is always good, and Hassall's fluid of meat mixed with it is a good addition.

When swallowing becomes impossible, the cautious introduction of a fine tube down the passage may be entertained, liquid food being thus introduced. But this proceeding is a hazardous one and can rarely be repeated for many days. Nutritious enemata appear to me to be preferable, beef tea thickened with flour or arrowroot, and milk and egg administered alternately every four hours, tending more than anything else to keep up the powers. When all these means fail, or rather before—for it is known that life cannot be very long maintained under such circumstances—the question of opening the stomach by an operation must be entertained.

Billroth recently has cut down upon the œsophagus and excised the cancerous growth, but without success; it is an operation that is only commended to our consideration by the eminence of the surgeon who performed it.

Foreign Bodies are occasionally arrested in the pharynx; when pointed they may become fixed in the soft parts about the base of the tongue, or between the pillars of the fauces; when bulky and solid, they are generally arrested at the narrowest portion of the tube, its lowest portion, behind the cricoid cartilage. The discomfort caused by this accident is at times very great; difficulty in swallowing, pain, and the disposition to vomit being common symptoms. A pricking sensation in the part is generally present, although it must be remembered that this symptom often remains after the substance has been dislodged. Where the epiglottis or upper orifice of the

larynx is irritated, cough and other laryngeal symptoms will be produced. The same may also be said when a solid body becomes impacted behind the larynx, the larynx being either mechanically so compressed as to cause suffocation, or so irritated as to give rise to spasm, either cause being sufficient to cause death.

When small bodies lodge in the part, they will set up inflammation and suppuration; abscesses in the pharynx and neck are not uncommon consequences; indeed, instances are on record in which disease of the cervical vertebrae has been the result. Coins may be impacted in the pharynx for many months, and Dr. O. Ward relates a case ("Path. Trans.," 1848-9), in which a halfpenny was so placed for eight months, the child at last, in a fit of coughing, bringing it up.

TREATMENT.—Whenever a foreign body, large or small, is suspected to have become lodged in the pharynx, a careful surgical exploration should

be made with a view to its removal. The mouth and fauces are readily reached by the index finger, and on carefully passing this around the mouth, base of tongue, and fauces, any foreign body will be detected; no force need be employed, the finger should only sweep the surface of the parts; by doing this the foreign body may be dislodged, the finger-nail materially assisting. When any body is fixed in a part, it may be removed by forceps, the ordinary dressing forceps, as a rule, sufficing; when the body is lower down, the œsophageal forceps, as made for

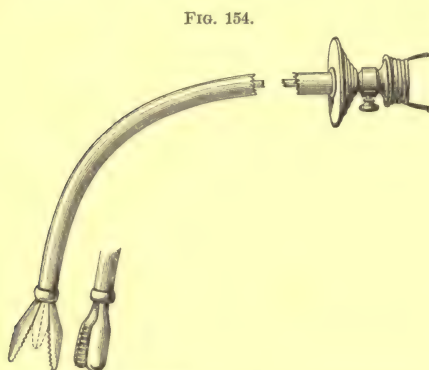


FIG. 154.
Revolving pharyngeal forceps for the removal of foreign bodies, &c.

me by Mr. Krohne, of Duke Street, Manchester Square, and figured above, may be used.

When a solid mass has become impacted behind the cricoid cartilage in the lower part of the pharynx, and the finger cannot dislodge it, laryngotomy may be called for to preserve life. Force should never be employed to push it down the œsophagus into the stomach. Should a second attempt to move the impacted body fail, it is well to desist for a time, a renewal at a subsequent date often succeeding, owing to the disappearance of the spasm which existed when the first attempt failed. Soft bodies likewise become softer, and can be consequently the better removed or pushed downwards; a good deal may, however, be done by digital manipulation, both inside and outside the mouth, to dislodge any foreign body. False teeth not unfrequently become dislodged and impacted in the pharynx. Paget has related such a case, where a man in a fit got one of his sets into the pharynx, and kept them there for four months. Mr. Paget dislodged them from between the base of the tongue and the epiglottis ("Med. Times," 1862).

Some five years ago when performing ovariectomy upon a lady, under chloroform, alarming symptoms of suffocation set in, and on opening the mouth I found half a set of teeth had become dislodged, and had fallen into the pharynx. I have also heard of several similar cases. When such bodies become impacted, much care is needed in their extraction, and the utmost gentleness should be used. Before giving chloroform to old people the teeth should be examined, and false sets removed. The laryngoscopic

mirror is often of great service in detecting the presence of a small impacted body, and in guiding the surgeon to its position.

Wounds of the Pharynx are occasionally met with from accident, falling with a sharp body in the mouth being the most frequent; when they do not involve any large vessel, they generally do well. Durham relates a case in "Holmes's System of Surgery," vol. ii, where Mr. Johnson, of St. George's, had to ligature the carotid artery, for repeated bleedings following a punctured wound of this part from the end of a parasol. It was in a boy *æt.* 7; a good recovery ensued.

Foreign Bodies in the Œsophagus are mostly arrested at its origin behind the cricoid cartilage, or at its lower end, just above the diaphragm, the two narrowest portions of the tube, and anything that can be swallowed may be so impacted. The symptoms the accident causes are extremely uncertain; when the upper part of the tube is obstructed the laryngeal symptoms are generally alarming; when the lower end, and the obstruction is not complete, they may be very slight. As a rule, however, besides the mechanical symptoms the mere presence of a foreign body in the tube may cause secondary inflammatory symptoms, which may give rise to a fatal result. Thus, a case is on record in which a fish bone perforated the heart, and caused a fatal hemorrhage (Andrews, "Lancet," 1860); another, where a sharp spicula of bone ulcerated on the third day into the aorta (Spry, "Path. Trans.," vol. xix, 1868); a case where disease of the spinal cord ensued as a consequence of ulceration of the intervertebral substance, following the arrest of a piece of bone in the Œsophagus (Ogle, J. W., "Path. Trans.," vol. iv, 1853); and another, in which a piece of gutta-percha formed for itself a bed in the wall of the Œsophagus for upwards of six months, and destroyed life by causing ulceration into a vessel and hemorrhage (Erichsen). In another case a man died suddenly from hæmatemesis, the cause being discovered after death to be a half crown impacted in the Œsophagus, and ulcerating into the aorta. One case is recorded where a fish bone passed through the posterior wall of the Œsophagus, and was found imbedded in pus in front of the vertebral column (Gairdner, "Med.-Chir. Soc.," Edinburgh, 1859). My friend Dr. Sutton has also told me of a case where a lunatic so plugged his pharynx with tow as to cause his death by suffocation.

Diagnosis.—It is quite impossible for a surgeon to speak with certainty as to the presence or absence of any foreign body in the Œsophagus under all circumstances. When it can be felt by the finger or bougie, no doubt can be said to exist; but, on the other hand, it may often be present when no such evidence can be obtained. A foreign body of small size may become so fixed in one side of the tube as to escape detection in the passage of an instrument.

TREATMENT.—When a foreign body is detected, the sooner it is taken away the better. Should the material be *soft* and *digestible*, it may be pushed downwards by means of the ordinary sponge or ivory probang, or tube of a stomach-pump, care being taken not to use much force, for such material will soften after the lapse of a few hours by the natural secretion of the part, and will thus be more readily pressed on. Should the offending

FIG. 155.



Preparation showing a piece of pudding impacted in Œsophagus of a child, *æt.* 2 years, which caused death by laryngeal spasm. Guy's Hosp. Mus., 1793⁴⁰.

body be pointed, hard, or large, all idea of pushing it on must be dismissed, for such practice is most dangerous; it has, however, been done with im-

FIG. 156.



Horsehair probang expanded and unexpanded.

punity, a jagged plate with teeth having been pushed into the stomach and passed per anum. *Small pointed bodies* may be caught by the "horsehair" probang passed carefully beyond the position in which the foreign body is supposed to be placed, and then gently expanded, rotated, and withdrawn, the compression and rotation of the instrument causing the hair to spread out and expand the œsophagus. *Sharp-pointed bodies* or *impacted hard irregular bodies* should be removed by forceps when possible. Those made for me, and figured (No. 154) by Messrs. Krohne & Sesemann, of Duke Street, Manchester Square, are the best, for they can be made to open in all directions when in the pharynx.

Vomiting will often cause the dislodgment of a foreign body, but at times it may render it more fixed. Swallowing a large bolus of bread may likewise carry downwards any fine bone or bristle, a draught of liquid assisting the process.

FIG. 157.



Money probang, with sponge at one end.

When vomiting cannot be produced by the administration of medicine, a solution of tartarized antimony, or of apomorphia injected beneath the skin is said to do as well.

Coins and other flat but not pointed bodies may often be removed by means of the money probang (Fig. 157), the circular hook catching the coin and drawing it upwards.

Œsophagotomy has an established position in practical surgery, and the observations of Arnott, made many years ago, are now fairly acknowledged: "where a solid substance, though only of moderate size and irregular shape, has become fixed at the commencement of the œsophagus, or low down in the pharynx, and has resisted a fair trial for its extraction or displacement, its removal should *at once* be effected by incision, although no urgent symptoms may be present." ("Med.-Chir. Trans.," vol. xviii); and Cock, writing in 1868 ("Guy's Rep."), says: "The longer a foreign body is allowed to remain, unless we wait—a forlorn hope—for suppuration to loosen it, the more firmly it will become impacted. It would appear that success has attended a speedy operation; whereas, where the use of the knife has been delayed until local inflammation, suppuration, or even sloughing has been established, the result of the operation has been fatal." Mr. Durham tells us that out of twenty-one cases of the operation for the removal of foreign bodies seventeen were successful, and in the four fatal cases death was in no way to be attributed to the operation. ("Holmes's Surgery," 1870, vol. ii.) In recent times the œsophagus has been opened

for stricture and cancer of the passage. Dr. Menzel reports ("Wiener. Med. Wochenschrift," No. 56, 1870) two cases in which Billroth performed œsophagotomy. The one which was successful occurred in a boy, æt. 11, who seven years before had swallowed some potash lye. Two days before the operation neither liquid nor solid food could be swallowed, and no bougies could be passed. The œsophagus was opened and a cherry-stone, which had been fixed in the stricture, was removed. The boy drank water directly afterwards, and in twenty-six days the wound had healed. The report does not say that he could swallow freely. The second case was for cancerous disease, but the man died.

The Operation.—The patient should be placed in the recumbent position with his shoulders slightly elevated, the head being turned to the right or left side, according to the point of projection of the foreign body. Where this guide is lost the left side should be selected, the œsophagus inclining rather to that side. An incision should be made along the anterior border of the sterno-mastoid muscle, about four or five inches long, its centre corresponding to the position of the foreign body, and all the soft parts carefully divided. The omo-hyoid will then come into view, and beneath this the carotid sheath with its vessels will be seen. Should more room be required the sterno-hyoid and sterno-thyroid muscles may be partially divided. The vessels, with the sterno-mastoid muscles, should then be drawn well outwards by means of the hook retractors. The larynx with the œsophagus behind can then be examined, and the position of the foreign body accurately made out, pressure with the fingers on the opposite side tending materially to make this point clear. Should the foreign body project, the larynx may be drawn well forwards or towards the opposite side, and a cut made down upon the projecting part, the wound being carefully enlarged to allow of any extraction without force. Where a guide is wanted to the œsophagus, the introduction of a long pair of forceps through the mouth downwards into the pharynx is a good help, the point of the forceps pressing forwards the œsophageal wall. All vessels that bleed during the operation should be at once twisted or ligatured, and on opening the œsophagus the recurrent laryngeal nerve should be carefully avoided. The wound should be left open. The patient must be fed for a few days by means of a small œsophagus tube, introduced through the mouth into the œsophagus below the wound, care being taken during its introduction to keep the point against the opposite wall. Convalescence, as a rule, goes on steadily. I have been fortunate enough to see the operation twice performed by my colleague, Mr. Cock, and the facility with which it was done has given me a very favorable opinion of its value.

CHAPTER XXXI.

INJURIES OF THE ABDOMEN.

SECTION I.—CONTUSIONS AND RUPTURE OF THE VISCERA.

INJURIES of the abdomen, like those of the cranium, derive their principal importance from the nature of the contents of the cavity. The integuments and muscles forming its parietes may be severely injured, and results follow which are simply of local importance; but if the peritoneal lining of

the cavity, or any of the viscera, are in any way injured, the case assumes a grave aspect. The presence of a wound is always an extra element of danger, the amount greatly depending upon the extent and character of the visceral complication.

Under certain conditions a trifling blow on the abdomen may give rise to symptoms of an alarming nature, when a severe one is thrown off without exciting more than a fear. "The absence of shock immediately succeeding a severe lesion may lull suspicion, as its presence may by simple contusion excite alarm." Every abdominal injury, however trivial it may seem, must consequently be regarded with apprehension, and the utmost care observed in its treatment and caution in its progress. This can be readily accounted for, says Poland ("Guy's Rep.," 1858), when we consider the numerous and vital structures contained in the abdomen: a serous membrane highly prone to inflammation; the "peritoneum," occupying an extensive amount of surface; a lengthy coil of organized tubing, "the stomach and intestines;" solid substances, made up chiefly of bloodvessels, &c.; the liver, spleen, and kidneys, readily lacerable and liable to rupture, causing nearly always fatal hemorrhage; receptacles for fluid, "the gall and urine bladders," which, under distension and undue force, may burst; large vessels coursing along the posterior wall, "the aorta, vena cava," &c.; and lastly, above all, the sympathetic nerves, consisting of the solar plexus and its numerous satellite plexuses and branches of such high organic importance, that injury or shock thereto may be attended with irreparable results. All these structures are, moreover, inclosed within soft elastic parietes, capable of great distension, which although readily able to resist shock and external violence without injury to themselves, yet may allow the force to be transmitted and expended on the contents with dire effect, and yet without leaving a trace or mark in the exterior.

In forming a diagnosis in this class of cases the method of exclusion is the only sound one, every possible complication being entertained and dismissed only when the weight of evidence is against it, the ultimate conclusion being founded as much on negative as on positive evidence.

"I am unacquainted," writes Le Gros Clark ("Surgical Diagnosis," 1869), "with any diagnostic sign by which we may predicate whether shock following an abdominal injury, exists primarily, apart from, or as expressive of actual breach of texture. Time alone can develop the true nature of the case, either by renewal of vigor or by the development of fresh symptoms."

A person receives an injury to the abdomen from a blow, fall, or the passage of a wheel over the part. This may cause a contusion of the abdominal wall more or less severe, with no visceral complication whatever; or it may produce a laceration or rupture of a viscus or vessel that will end in death, without any (or very slight) external sign of injury.

Pain, as an immediate effect of the injury, is no indication of internal mischief, for in simple abdominal contusions it is at times very severe; but when it *lasts* or becomes *fixed* in one spot, it is a symptom of importance. When it *radiates* from one spot it is most characteristic.

Persistent Vomiting is a suspicious symptom of visceral mischief.

Collapse, as a direct consequence of a blow, when of a passing nature, is of small value as a diagnostic sign; but if *persistent* or *relapsing* indicates grave mischief; collapse, more or less complete, is a common effect of all abdominal injuries, but a collapse coming on at a distant interval of time following the injury, as a rule means hemorrhage.

How far sudden death is attributable to a shock or collapse from a blow on the epigastrium or stomach without organic lesion is an open question,

sound evidence being wanting to prove the point. Taylor, in his work on Jurisprudence, gives one case, that of Mr. Wood, in which a man, when fighting and intoxicated, suddenly died after the receipt of a left-handed blow on the pit of the stomach; but the evidence in the case and the facts revealed at the post mortem are by no means conclusive as to the cause of death. The opinion has probably been accepted, on the authority of Sir A. Cooper, who was in the habit of relating how two men were working, one of whom was wheeling along a heavy load, when his comrade thus addressed him: "That is too much for you; stand aside, and let me, a better man, take it." He accompanied this with a slight blow on the *scrobiculus cordis*, and the man immediately let the barrow fall. The man died on the spot, and after death no lesion was discovered. This case, however, had only been related to Sir A. Cooper. No better case can be brought forward to support the theory. Under these circumstances, I think, Mr. Pollock must be right when he asserts that he is somewhat skeptical on the point, that death can occur without any organic mischief resulting from the blow at the time; that sudden death, attributable to a blow on the stomach or epigastrium, must be a rare occurrence; and that medical men should be extremely guarded in ever offering an opinion as to the cause of death in such supposed injuries, without satisfying themselves, by most careful and minute post-mortem investigations, that no violence has been done to the viscera, either abdominal or thoracic. ("Holmes's Surgery," vol. ii.) This question may, therefore, be put aside.

What then, it may be asked, are the usual consequences of an abdominal injury or contusion? What are the risks and complications? The following facts will perhaps illustrate these points.

At Guy's Hospital, during eight years, seventy-one cases of abdominal injuries were admitted. In *forty-four* of these, beyond a passing collapse, no serious or definite symptoms were produced; tenderness over the injured part from the contusion was the most marked, but no evidence of any internal mischief was ever manifested. Rest in bed for a few days was the chief treatment, associated with the local application of a warm fomentation. In all convalescence was rapidly established. In *ten cases* symptoms of *peritonitis* showed themselves, such as excessive tenderness over the injured part, increased by movement; thoracic respiration resulting from the indisposition of the abdominal muscles to act, and thus by pressure on the inflamed peritoneum to cause pain; nausea, and in some cases vomiting, fever, and constitutional disturbance, varying according to the severity of the inflammation. In seven of these ten cases *absolute rest* in the horizontal posture, warmth applied locally, either by means of fomentation or cataplasms, in some instances leeching, and *in all opium* given in moderately full and repeated doses was the treatment adopted; and in every case the inflammation was subdued before it had attained a dangerous degree of severity. In *three cases*, however, an acute peritonitis set in, and in one of these a fatal termination was the result. In *seventeen cases* rupture of the viscera took place. As a type of an ordinary case of peritonitis after injury the following case is given:

A man, *æt.* 22, in a fight received a blow from a woman on his right side; the accident was followed by syncope, from which he soon recovered; he felt no pain or inconvenience from the injury for one week, having, as usual, followed his occupation. At this date severe abdominal pain was experienced at the seat of injury, which rapidly increased and spread over the whole abdomen; vomiting also appeared, accompanied with considerable constitutional disturbance; in this condition he was admitted into Guy's. He was put to bed, and twenty leeches were at once applied; a

grain of opium was given, and repeated three or four times daily, and perfect rest enjoined; in a few days these symptoms subsided, he was enabled to take food without vomiting, and pain ceased, convalescence being gradually established.

REMARKS.—The case is interesting from the fact that some days elapsed between the receipt of the injury and the appearance of the peritoneal symptoms, as well as from the important practical point to be learned from the rapid success that followed upon the treatment which was pursued. Rest to its fullest extent was doubtless the chief element of success—rest by position in the horizontal posture, and rest maintained by the administration of opium. It is not unfair to believe that, if this treatment had been primarily adopted, the symptoms exhibited would never have made their appearance; but by the man following his occupation, the repair which was required after the injury could not be efficiently carried out, and, as a consequence, inflammation ensued. Of all cases which require absolute rest, abdominal injuries demand it most, and in no example, however apparently trivial, should it be neglected. If the mischief is but little, that little will more rapidly be repaired; if great, its evils and its consequences will be materially modified. The case above quoted indicates both points, viz.: its primary necessity and its secondary good results.

It is thus seen that a blow upon the abdomen may be followed by a simple contusion of the abdominal wall, and in exceptional cases by peritonitis; this may terminate fatally, but in the majority of cases where such a result ensues it is from rupture or lesion of some internal part.

What then are the symptoms of an internal abdominal lesion? How is it to be made out that such exists? What guides are there to the viscus that is wounded?

To answer these questions satisfactorily much space is needed, more, indeed, than can be given to it in this work; yet helps to diagnosis may be given.

The nature and position of the injury afford a kind of clue. Where the loins are the part involved, the kidneys are prone to suffer; where the right hypochondriac region is the seat of injury, and the ribs on that side are fractured, the liver is probably the organ injured. On the left side the stomach is the organ likely to be hurt, or more probably the spleen; in the umbilical region the intestines; in the pelvic region the bladder.

Rupture of the Liver usually destroys life by hemorrhage; in the majority of cases within a few hours of the injury, in some within a few days; thus out of nine consecutive cases of ruptured liver five died rapidly, three survived three, seven, and nine days respectively.

When the laceration is *extensive* death is always speedily produced by the shock and hemorrhage; coldness and general pallor of the whole body, with a feeble pulse, sighing respiration, and restlessness preceding death. When the laceration is *less severe* life may be prolonged; thus I have recorded in another work the case of a man æt. 45, who when drunk fell out of a cart, and the wheel was said to have passed over his head. He was admitted, intoxicated to an extreme degree, under Mr. Birkett's care into Guy's Hospital, and he presented no evident symptoms of internal injury beyond slight hemorrhage beneath the right conjunctiva, indicative of cranial mischief. He was put to bed, and soon fell asleep, and on the following morning, with the exception of the hemorrhage into the orbit, *no signs* of mischief could be detected. Rest, however, in the horizontal position was strictly enjoined; but to this the man would not submit, and thirty-six hours after the accident he would get up and walk about; having done so, he felt a sudden pain in his side, fell back, and died. After death

a fissured fracture passing across the right orbit was found, without brain complication; the peritoneal cavity contained about a pint of blood; this had evidently come from a severe laceration of the liver, a mass the size of a man's fist situated in the right lobe having been nearly separated. The right kidney was also fissured on its surface, and covered with coagulated blood.

In rare instances the liver may be crushed partially, and its peritoneal covering be left uninjured; in such cases life may be prolonged, and when the mischief is not extensive it may be saved.

Fissures of the liver are usually met with on its upper surface. A diseased organ is more liable to rupture than a healthy one.

There is little doubt that recovery may take place when the fissure is limited and the case uncomplicated; when these cases occur they are classed with those of traumatic peritonitis; and when proving successful their true nature is not revealed. Preps. 1948-1951⁵ in Guy's Hosp. Museum, with drawings, illustrate this truth.

The Spleen is frequently injured, and such cases are by no means always fatal. It is sometimes lacerated by a fractured rib, or torn by a dragging of its surface. When fatal it destroys by hemorrhage. Prep. 2018, Guy's Museum, illustrates its repair after injury.

Rupture of the Stomach generally proves fatal from shock alone, or irrecoverable collapse; the amount of distension of the organ, its contents, and the extent of laceration influencing the result. When the rupture is large, and effusion of its contents into the abdominal cavity takes place, acute peritonitis, with or without hemorrhage, will kill, if shock does not. When the rupture is small, and the stomach empty, there is a chance of recovery, local peritonitis subsequently gluing the injured part to the surrounding tissues.

When life is prolonged beyond immediate death, the patient will complain of an acute and constant pain radiating from the seat of injury, so peculiar indeed that "the intensity of it absorbs the whole mind of the patient, who, within an hour from the enjoyment of perfect health, expresses his serious and decided conviction that if the pain be not speedily alleviated he must die." Vomiting is a constant symptom, first of the contents of the stomach, and often of blood; collapse, rigors, and syncope are often met with.

Incomplete rupture of the coats of the stomach is found sometimes after death. In Guy's Museum (Prep. 1817²⁵), there is a stomach of a child æt. 7, in which the mucous membrane is detached and lacerated in a remarkable manner from a sudden blow while the stomach was full.

Rupture of the Intestines, both of the large and the small, is a somewhat common form of abdominal injury; a fall, a blow, the passage of a wheel over the abdomen, or even violent muscular exertion may produce it.

Hennen ("Military Surgery") gives a case where a soldier received a contusion of the abdomen; sloughing of the integument followed, and artificial anus, but in six months a recovery took place, the feces having resumed their natural course. In Guy's Museum there is a specimen (Prep. 1851⁸⁵) of perforation of the small intestines of a man who had received a kick from a horse; he died thirteen days after the accident with extensive peritonitis, following fecal effusion. Prep. 1851⁸⁶ consists of a portion of jejunum, taken from a man who had been kicked in the abdomen; the injury was quickly followed by symptoms of extravasation, and death in forty-eight hours; Prep. 1850⁸⁸, was taken from a case of perforation of small intestine from the kick of a horse, terminating in death in twenty-

four hours; No. 1851⁸⁹ is a portion of jejunum presenting two openings in which the mucous membrane is inverted following the blow from a kick in the abdomen; No. 1851⁹¹, is an example of laceration of the jejunum; the bowel is seen to be completely divided: this was taken from a man æt. 37, who was run over by a cart, and lived twenty-four hours; and, lastly, the specimen marked 1851⁸⁷ is from a case that occurred in the practice of my father, the late Mr. T. E. Bryant, of Kensington; it is a portion of ileum having a small perforation, produced by a blow in running against a post; a state of collapse came on, the patient did not rally, but died on the third day.

Cases are also on record in which a portion of intestine has sloughed after an injury, and subsequently passed per rectum, a recovery taking place. In the Anatomical Museum of the University of Edinburgh several such preparations exist.

The Duodenum is rarely ruptured, its position protecting it; nevertheless such an accident does occur. Taylor, in his "Med. Jurisp.," gives a case where a boy æt. 13, after a blow on the abdomen, walked a mile with but little assistance. He died thirteen hours after the accident, when the duodenum was found to be completely ruptured across.

The Jejunum is doubtless more frequently ruptured than any other part of the intestines, its fixed position rendering it liable to be torn away from the duodenum by any injury, such as the passage of a wheel. Poland gives fourteen examples, and in half of them the laceration was at its upper part. In one case, three or four pints of thin pink-colored fluid was found after death in the abdomen, probably the iced water of which he had freely partaken after the accident. In all, death took place from collapse and peritonitis.

The Ileum is also frequently ruptured, and most commonly from a direct blow or fall on a hard body. In a majority of cases there is no external mark of injury; fecal effusion and peritonitis are the usual cause of death. When the rupture is large little hope exists of a recovery; when small, such a hope may be entertained.

When a patient is the *subject of hernia* and receives a blow upon the tumor, a ruptured intestine may doubtless take place. Aston Key made this the subject of a memoir in the "Guy's Reports" for 1842, and Poland has collected many such cases in the same periodical for 1858. Rupture of the gut is the usual result, and when it occurs a fatal termination is to be expected. When the bowel is only bruised it may recover or slough, giving rise to an artificial anus.

In none of these cases should any attempt at reduction be made, when symptoms of inflammation or of injury are severe. The surgeon should, however, explore the sac. In all recorded cases where the bowel was returned, a fatal result took place.

The *large intestine* is rarely ruptured from violence. When overdistended, such a result may take place; but under ordinary circumstances it is too well protected.

TREATMENT.—The chief point to insist on is the absolute necessity of treating *every case* of injury to the abdomen with excessive caution; for very severe mischief may be caused by violence, and yet the immediate symptoms may not be marked. Collapse after the injury, as has been shown, is by no means a necessary consequence; rupture of the intestine itself taking place without exciting such a condition; indeed a patient may walk after a ruptured liver or intestine. The surgeon should, therefore, be guarded in his prognosis, and careful, watchful, and expectant in treatment.

In every case secure and maintain absolute rest. If the injury be slight, by

such treatment convalescence will soon be established ; if severe, secondary bad results may be prevented, and at any rate will be relieved. Under two weeks no case of abdominal injury can be pronounced well.

If local tenderness exists, fomentations or cataplasms should be used ; and if this amounts to pain, leeches in good numbers—twenty or thirty—must be applied and opium given ; this valuable drug should be administered in small and repeated doses, for it answers many purposes—it allays pain, and assists wonderfully in maintaining rest to the injured peritoneum and viscera, tending thus materially to arrest inflammatory action.

The patient should be kept free from all excitement, and as little nourishment administered by the mouth as will suffice to sustain life ; if the intestines are believed to have been ruptured, *starvation* must be carried out. What is given should be liquid and cold. Milk and ice is the best and simplest combination, and upon this life will be sustained without difficulty. If great thirst exists, a little ice may be given ; but this must be administered with great caution, as a case already quoted well illustrates. When the intestine is believed to be injured, this latter treatment must be most guarded ; the patient's powers may be kept alive by enemata of beef tea administered in small quantities—three or four ounces repeated at short intervals.

On no account administer a purgative. This rule is a golden one in these cases, and should never be deviated from ; by doing so in a careless moment, the whole of nature's processes in repairing the injury may be undone, and irreparable mischief follow : the constipation is the sign of a condition of bowel towards preserving which all our treatment is directed when keeping them at rest ; a purgative is nothing but an irritant, and is in its effects absolutely destructive.

In all cases the prognosis and treatment should be most guarded, cautious and expectant ; perfect rest, locally and generally, should be maintained, and all sources of irritation removed and kept away ; by such treatment, and such alone, can recovery be anticipated, and nature's processes of repair be fully carried out.

In all cases of abdominal injury *look to the state of the bladder*, for retention of urine from disturbed nerve influence is a common accompaniment of such cases and should not be overlooked.

Rupture of the Kidney is an accident from which recovery is more common than from that of any other viscus. Its position in the loins, outside the peritoneal cavity, is doubtless a sufficient explanation of this fact. When not very severe, and uncomplicated with other injuries, such cases usually do well. It is generally known by an attack of hæmaturia following a blow in the lumbar region, local pain as a rule coexisting. This hæmaturia may be only passing, and cease after the lapse of two or three days, when it is probable that only a contusion of the kidney had taken place, for in severer injuries the bleeding lasts fifteen days or more. At times clots will be passed, assuming the shape of the ureter. I have before me the notes of some half a dozen cases in which these symptoms were present, and from which recovery took place. Retraction of the testicle is an occasional symptom and pain in the course of the ureter.

The treatment pursued was rest in bed and milk diet. In one instance, where the bleeding was profuse, a grain of the acetate of lead was given with half a grain of opium three times a day. Gallic acid in ten-grain doses is also a good drug under similar circumstances. Opium must be given with caution.

When the organ is crushed, the injury is likely to be complicated with other mischief, and under such circumstances peritonitis and hemorrhage,

singly or combined, are likely to prove fatal. When the organ is single and becomes injured a fatal result is also likely to occur. In page 125 of my "Clinical Surgery" I have recorded such a case.

When peritonitis exists, opium is of great value; where urinary abscess in the loins follows, as it occasionally does, particularly in gunshot wounds, the surgeon must make a free incision into it; a deep incision made on the outer border of the quadratus lumborum muscle may be fearlessly made.

Rupture of the Ureter was first noticed by Stanley in the "Med. Chir. Trans.," vol. xxvii, where two cases are related, a fluctuating tumor formed by the effusion of urine existing in both. Poland, in the "Guy's Rep." for 1869, has recorded a third case. Beyond these no others are on record. Four cases of wounded ureter are, however, published by Hennen ("Mil. Surg."). It seems in all these cases the ureter was ruptured by stretching, its renal end having suffered.

The symptoms are very obscure, particularly where no external wounds exist; indeed, there are none to indicate the nature of the accident in its early stage. At a later period a lumbar tumor may appear of a cystic nature, caused by the retention of the secreted urine, and there may be more or less peritonitis; when this appears there is little doubt that a free opening into it in the loin is the correct treatment. Under other circumstances the case must be treated, as all others of abdominal injury, by rest and opium.

Rupture of the Gall-Bladder has been recorded as the result of accident, and when it occurs death is usually rapid. The accident is marked by extreme collapse and pain in the seat of injury. Poland, in his "Fothergillian Prize Essay," has given us such a case, and Dr. Fergus, in the "Med. Chir. Trans.," vol. xxxi, has recorded another. In one case death occurred from collapse, in the second from peritonitis.

Rupture of the Hepatic Duct may also occur. In Poland's Essay an instance is recorded: it occurred in a boy as the result of a blow on the abdomen, and the accident was quickly fatal. My friend Dr. Sutton has kindly given me the details of a second case, which took place in the London Hospital in 1867. It was on a man, æt. 29, who was knocked down, and the wheel of a spring dray passed over his stomach. He felt pain in the right hypochondriac region directly, and "had hard work to get his breath." Abdominal pain increased and jaundice appeared, and for one month he kept his bed. On the thirtieth day after the accident, as he did not improve, he was admitted into the London Hospital, under Dr. Herbert Davies and Dr. Sutton. When in the hospital he had abdominal pain, tenderness, and distension. There was distinct ascitic fluctuation over the abdomen, and deep jaundice. He sank eight days after his admission, thirty-eight days after the accident. The autopsy revealed the fact that the hepatic duct was torn across a quarter of an inch above the spot where the cystic joins the common duct; no other part of the liver was injured. The abdominal cavity contained quarts of olive-green bile-stained fluid, and the peritoneum was covered with yellow matter of the color and consistence of yellow paint, which was found to be inspissated bile.

Rupture of the Urinary Bladder without fracture of the pelvis, as the result of some abdominal injury, is also met with, and when it occurs it is usually due to external violence applied to a distended organ. As a rule the rupture takes place at its posterior wall, the urine escaping into the peritoneal cavity, and rapidly causing death; in exceptional cases it affects the anterior wall, when the urine infiltrates the cellular tissue of the pelvis. Birkett tells us ("Holmes's Surgery," vol. ii) that, with three exceptions, all the cases recorded terminated fatally. In one only of these three was

the peritoneum involved (Chaldecott's case, "Prov. Med. Surg. Journ.," 1846), in the other two the extravasation was into the pelvic connective tissue. Dr. Stephen Smith, of New York, in an able monograph, 1851, reports five cases of recovery out of seventy-eight, these figures not including one of Birkett's (Porter's case), consequently the recoveries reported may be taken as six.

The symptoms of the injury are mostly collapse preceded by severe abdominal pain and ineffectual attempts to micturate. Should life be prolonged, peritonitis more or less acute will appear. Dr. Smith reports three cases in which the ability to urinate continued, and twelve in which it returned on the second or a later day.

Rupture of the bladder with fracture of the pelvis likewise occurs.

Should the surgeon be induced to pass a catheter from the ineffectual efforts of the patient to pass urine, it will often happen that no success will be achieved, but in some cases a vast amount of fluid will be withdrawn, the catheter under these circumstances having doubtless been passed through the rent or the posterior wall of the organ into the peritoneal cavity. I have known a case where several pints were drawn off under these circumstances.

TREATMENT.—When any time exists for treatment the indications are to *allow of a free exit for the urine as secreted*, and to check peritonitis. A certain amount of peritonitis must be looked upon as beneficial, for it tends towards the first indication of treatment, the prevention of extravasation, but any excess of action requires prompt treatment. Opium is without doubt the best drug to promote this end, a full dose of the solid opium or the tincture being given, and followed up to maintain its action; absolute rest, local fomentations, and possibly leeches are valuable adjuncts. As little food should be given as is absolutely necessary to maintain life, and ice in moderation to allay thirst. The bladder should be kept empty, the maintenance of a large catheter in the viscus, with an opening in the end, being the best method, according to Birkett; but it seems probable that a free incision through the perinaeum into the organ, as in lithotomy, is the better practice. When the bladder is ruptured from a fracture of the pelvis, the same treatment is called for.

Injury to the Uterus, when large from pregnancy, deserves a passing notice, for such cases are serious. A contused organ may inflame, and be followed by abortion or miscarriage, or should pregnancy continue, its structure may be so altered as to be liable to rupture. I have known also an intra-uterine fracture of a child's thigh to take place as a consequence of a fall. In obstetric works also cases are recorded in which a distinct rupture of the organ followed.

Rupture of an Ovarian Cyst from a blow is also recorded, and under certain circumstances a good result may take place; all obstetricians have met with such cases; as a rule, however, a fatal peritonitis follows.

Rupture of the Diaphragm is an accident that occurs in practice, but is difficult to diagnose; it is generally the consequence of some violent injury, such as a crush, or the passage of a heavy wheel over the waist. In such cases the injury is complicated, and it is so usually with hernia of the abdominal contents into the thorax. This injury can only occur on the left side. Dr. Wilks, in the "Lancet" for 1858, reported three instances of this diaphragmatic hernia, and pointed out that *excessive thirst* was the most prominent symptom in each. I had the opportunity of seeing these three cases and others since have come under notice, and this symptom seemed to be most characteristic, the thirst was unsatisfying. In January, 1872, a similar case came under my care, and this symptom was equally well marked.

SECTION 2.—WOUNDS OF THE ABDOMEN, INVOLVING PARIETES AND VISCERA.

The parietes of the abdomen are often wounded from sharp substances, whether by accident or design, and so long as the wounds are confined to the parietes the danger is small. When the peritoneum is punctured or perforated the viscera are also probably involved, and under such circumstances the case becomes a serious one. In rarer cases the intestines protrude, when an additional element of danger is added.

Wounds of the Parietes alone require the same treatment as wounds of any other part. The surface should be well cleansed, and all foreign bodies removed. Hemorrhage should be arrested by torsion or ligature, and the edges brought together with sutures. In deep wounds, where the risk of suppuraton between the muscles or fascia is great, absolute rest should be enjoined, the muscles being relaxed by position. When suppuration appears the surgeon must be careful to let out all fluid, either by reopening the wound, or by a fresh opening. In all wounds of the parietes the surgeon should be particularly careful to arrest bleeding at once, and let out anything like pus as early as possible. *All punctured wounds should be left open*; when bleeding persists the wound should be enlarged and the vessel secured.

Penetrating Wounds of the Parietes.—There is always a difficulty in diagnosing these cases; that is, in making out the true nature of the accident, more particularly in punctured wounds. When the depth of the wound is known by the extent of insertion of the offending body, and the relative position of the viscera at the wounded spot, some notion as to its nature may be formed; but when no such guide is to be found, the surgeon has to rest upon other evidence, or upon surmise and probabilities; as a rule, where want of evidence is felt, it is well to treat the case as a serious one. All penetrating wounds are serious, whether incised, lacerated, punctured, or gunshot; punctured wounds are by far the most common.

When the viscera are *uninjured*, beyond the parietal wound, there will be a total absence of all other symptoms, *and these negative symptoms afford the best positive evidence of the simple nature of the wound*. When the viscera are injured there will generally be syncope, more or less lasting, or collapse; there will probably be severe local pain, soon becoming radiating; there will frequently be vomiting, possibly of blood, or the passing of blood from the bowel or bladder. If life is prolonged there will be peritonitis. When the bowel or omentum protrudes, when feces, bile, urine, or blood, appear at the wound, the evidence is clear. The surgeon will, however, find much help in forming an opinion from collateral evidence; thus, the size of the wound compared with the instrument that inflicted it; the position of the blood stain on the instrument; the force with which the blow was struck; the direction of the force in relation to the position of the patient; the thickness of the abdominal parietes. By all these means an approximate opinion may be formed, but in no case can a positive diagnosis be made with certainty. Under all circumstances, however, the *treatment* must be the same.

Rest.—Absolute rest being an essential point, no movement should be allowed, not even for natural purposes. *Opium* in moderate or full doses, according to circumstances, is also demanded, it being well to keep a patient under its influence for several days, by giving one grain every four or six hours. *Low diet*, that is, milk diet, should be allowed, all food being given cold and in small quantities; ice to suck is refreshing. *Purgatives* should

on no account be given till the nature of the case is declared. With respect to *local treatment*, the greatest simplicity should be employed. The wound should be cleansed, and all bleeding vessels secured, but anything like an exploration of the wound is to be condemned. All probing, fingering, or manipulating the wound should be avoided as only pertaining to surgical curiosity.

The abdominal muscles should always be relaxed by position, and the edges of the wound, when it is large, brought together by sutures. Water-dressing should then be applied. Punctured wounds when perforating, like others, should be left open. Even after the lapse of some days, when no symptoms of wounded viscera appear, the same caution should be observed, two or three weeks being always allowed before freedom is given. Under all circumstances the condition of the *bladder* should be inquired into.

SECTION 3.—PENETRATING WOUNDS, WITH PROTRUDING VISCERA.

It is hardly necessary to say that the special risk of any of these cases is determined greatly by the viscus that is involved, and the amount of injury it has sustained. Thus, a penetrating abdominal wound with protruded omentum is far less dangerous than when hernia of the intestine exists, and a wounded bowel is of graver importance than an uninjured one. It is consequently necessary for the surgeon in all these cases to run over mentally the position of the viscera, in order that he may form an opinion as to the probabilities of the case. Fig. 158 will refresh his memory on these points.

“Of the hollow viscera any portion of the intestinal canal may be protruded, from the stomach to the sigmoid flexure, according to the situation and degree of distension of the viscera. The small intestines most frequently, next the large, then the stomach, and, lastly, the cæcum. Of the solid viscera the omentum is by far the most common, and is often associated with that of the viscera.” (Poland’s “Prize Essay.”)

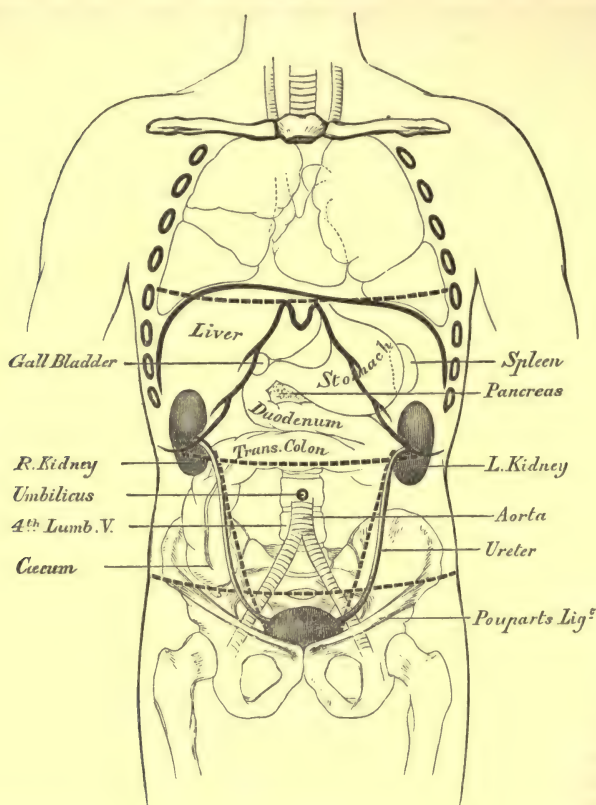
In *small* wounds a limited hernia of the abdominal contents can alone take place, and when it occurs the protruded viscera are very prone to be strangulated by the wound.

In *large* wounds the hernia will probably be of greater extent, and their constriction is rare.

When omentum protrudes from a recent wound, and no injury to it has been sustained, it should be washed by means of a small stream of water squeezed over it from a sponge or emitted from a syringe, and returned with all gentleness, the muscles of the part being relaxed. The wound should never be enlarged to allow of the return of omentum. When the omentum has been extruded for some time, and is congested from incarceration or strangulation, when it has become inflamed, or perhaps sloughing, it is well to leave the mass alone, at least, it is not wise to make any attempt at its reduction. As time goes on, and the projecting mass swells and granulates, it may be well to ligature the whole in halves; this should not, however, be done for at least two weeks after its protrusion. During this time the greatest quiet is to be enforced, and moderate doses of opium given, liquid food being allowed. After a few days all fear of peritonitis will have passed. Some surgeons prefer to leave the growth to natural processes, for sooner or later it will probably wither up, but such a process is tedious. The application of a ligature to it in halves is rarely attended with any risk, and may be undertaken. Should the omentum be much

bruised or torn at the time of injury, such injured portions may be cut off, all divided vessels being secured.

FIG. 158.



When the bowel protrudes through the wound, and is *unwounded* and whole, it should be cleansed and *returned under all circumstances*, the wound being carefully enlarged in the course of the muscular fibres for the purpose, should its reduction be impossible without. To facilitate this the muscle should be relaxed, and the parts last descended returned first. In returning the intestine the pressure should be directly backwards; if made obliquely, the bowel may be pushed up beneath the fascia or muscles, and thus outside the peritoneum. The wound should be closed by sutures, and treated as already described.

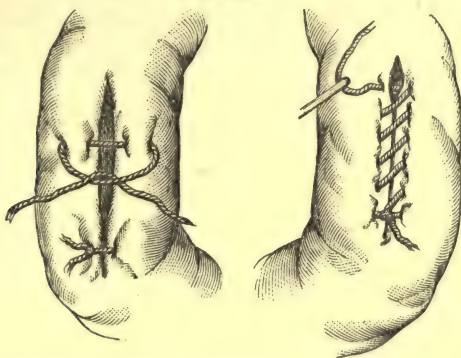
When the protruded bowel is *gangrenous*, that is, irreparably so, it must be left *in situ*, to slough, and for an artificial anus to form, the wound in the abdominal parietes being enlarged; where there is a prospect of its recovery the abdominal cavity is the best place for it.

When the intestine is wounded, and the opening a mere prick through which no intestinal contents exude, the bowel may be returned, a few hours being enough for the wounded part to become sealed by plastic exudation, and repair to be completed. When the mucous lining protrudes, the opening should be tied by a single ligature. When the wound is sufficiently

large to permit of the escape of the visceral contents, it must be stitched up with one of the forms of suture seen in Fig. 159, and then returned, the ends of the sutures being cut off close.

When the wound involves nearly the whole calibre of the bowel, it is a wiser plan to bring the edges of the bowel to those of the wound, and stitch the two together, thus making an artificial anus, than to stitch

FIG. 159.



Illustrating the application of sutures to the intestine. The thread is made thick for the sake of clearness.

the two divided ends of the intestine together, and return the whole into the abdominal cavity. Pollock (*"Holmes's Surgery,"* vol. ii) says if the division be caused by a clean sharp instrument, the extremities may be brought together with sutures and returned; but if the separation be the result of an irregular lacerated wound, as from gunshot, &c., we should not hesitate to fix the edges to the external wound, and risk the chance of an artificial anus. When the bowel is stitched to the edges of the external wound care should be taken to maintain the line of the canal as much as possible and not to draw the intestine more out of its position than is absolutely necessary to maintain the orifice outside the abdominal cavity.

The general and local treatment of all these cases is similar to that already laid down for the treatment of abdominal and visceral injuries.

Penetrating abdominal wounds complicated with wounds of the viscera, but without protrusion, are, without doubt, far more serious than any that have been hitherto considered, and their effects depend greatly upon the condition of the viscus when wounded. Thus a distended stomach, intestine, or bladder, when punctured, will to a certainty be followed by extravasation, and, as a result, by great shock and diffuse peritonitis; whereas these organs, when contracted, may receive a limited injury without any such consequences taking place, *local* inflammation rapidly arising under these circumstances and sealing the wound.

When the contents of the wounded organ escape externally through the wound, the danger of the case is undoubtedly lessened. The chief risks of wounded viscera are hemorrhage in the solid, and extravasation in the hollow ones. When the *stomach* is supposed to be wounded by a puncture the utmost care is called for by the surgeon to prevent the administration of any food; *nothing* should be put into the stomach for several days, life being maintained by nutrient enemata; for to excite any action of the organ would be to undo what nature can do for repair of the injury, and jeopardize life by increasing the risk of extravasation.

When the *intestine* is wounded, or suspected to have been wounded, the same care is called for, although ice or iced milk, in limited quantities, may be allowed to satisfy thirst.

Opium should of course be given, and it is best administered by suppositories, the morphia suppositories of the Pharmacopœia being the best preparation to employ in all cases of abdominal surgery. The principles of treatment are, however, the same as have been laid down in former pages. In all penetrating wounds of the abdomen in which any evidence of wounded viscera exists, the *local wound should be left open*, or covered only with a loose covering; for to so close the wound as to prevent the escape of the contents of the wounded viscus externally would be to close the only gate through which return to health is possible.

Abnormal Anus, Fecal Fistula.—Confining the term "*artificial anus*" to the surgical operation of forming an anus otherwise than natural for the relief of intestinal obstruction, &c., an "*abnormal anus*," or intestinal fistula—*fecal fistula*—or an unnatural communication between the intestinal canal and the outside of the body, is generally the result of a sloughing or ulcerating bowel in strangulated hernia; but it may occur from a wound of the intestine from some external cause, or from a perforation of the intestine from an ulcerating process originating from within.

When it follows a hernia, the opening is usually at the neck of the hernial sac; when it follows a wound, at the seat of injury; when it is the result of some ulcerative process originating from within, the fecal abscess may burrow into the pelvis (opening into the vagina, bladder, or even bowel again), or between the abdominal muscles, making its appearance in the groin, iliac fossa, or loin.

When the opening is a *large* and *direct* one into the bowel, it has been called "*artificial anus*;" when small, indirect, or fistulous, "*fecal or intestinal fistula*."

The most important point, however, connected with this subject has reference to the amount of intestine involved; when only a small portion of its calibre has been lost, the fistula will generally be small; when a large portion of its calibre or a whole knuckle has been involved, the fecal orifice will be large. Under these circumstances the two orifices communicating with the upper and lower ends of the bowel respectively can generally be made out, a fold of membrane formed by the junction of the bent tube standing as a partition between the two portions of the gut. At times this partition will project so far forward as to close completely the orifice of the lower part of the bowel, and this is the usual state of affairs when a complete knuckle of bowel has been involved in the disease, and under such circumstances a cure by natural processes is almost impossible. At other times the partition will be but limited, and a portion only of the contents of the bowel will pass externally, the other portion taking its normal course downwards towards the anus, when it is more than probable that nature alone, or but slightly assisted by art, will effect a cure. When the orifice is large there is almost always some prolapse of the bowel. Under all these conditions the intestines within the abdomen are closely connected by means of adhesions to the external orifice; the serous surface of the intestine becoming firmly fixed to the serous surface of the opening in the abdominal parietes. Beyond these adhesions it is a rare thing to find the other coils of intestine adherent about the part; but, on the contrary, the parts are otherwise usually so free that coils of bowel will be found separating the two portions of intestine that are adherent at the wound, and may so dip down between them as to push forwards a serous sac into the artificial opening, and even form a hernia. The nature of the discharging

fluid will fairly indicate the position of the bowel that is involved; when well-formed feces pass, the large or lower part of the small intestine is probably the seat; when the fluid is thin and inoffensive the jejunum is indicated. The yellow semi-feculent contents of the ileum can generally be recognized. The nearer the opening is to the stomach the worse is the prognosis, for nutrition under such circumstances must be seriously interfered with. The nearer it is to the lower end of the canal the better are the prospects of life.

TREATMENT.—When the orifice is fistulous, and the canal is fairly open for the passage of feces, a cure may with some certainty be looked for by natural processes; in the artificial anus *after the return of a small hernia into the abdomen*, and particularly of a femoral, such a result is by no means unusual, and the surgeon has little more to do than to keep up the strength of his patient—give simple nutritious diet, maintain perfect cleanliness of the wound, and apply gentle pressure to the part. When the fistulous communication is larger the same treatment must be employed, although with less hope of success. Indeed, except with small openings, there is no hope of a natural recovery. Lawrence recommended the constant use of a truss in these cases to prevent prolapsus, and Pollock strongly advocates the importance of the recommendation, adding, that “a compress of linen placed on the opening, with a larger pad over it, and a truss applied over the whole, will, in a great measure, restrain the contents as well as prevent the protrusion of the bowel.”

To assist the contraction of small fistulæ the edges may be cauterized, or even pared, a plastic operation being justifiable under certain circumstances.

With respect to surgical interference in these cases the recommendations I have to give are not very satisfactory. Dupuytren suggested an operation to get rid of the projecting fold or septum that has been described, but it is a dangerous proceeding. He did this by an instrument called an enterotome, a pair of forceps with one blade grooved, into which the other closed. The approximation of the blades was regulated by a screw. The septum was crushed between the blades, and so held till its destruction was effected. The instrument, as a rule, came away about the seventh day, and Dupuytren says, “By the division and loss of substance, the ridge and the double septum which separate the two ends of the bowel are destroyed so as to re-establish the interrupted communication between them, and restore the natural course of the aliment and feces.” Jobert advises the pressure of the instrument to be gradual, fatal cases having occurred when Dupuytren’s rapid process has been employed. The theory of this operation is very good; it is one, indeed, based on nature’s own processes; for I have seen the septum of an artificial anus ulcerated through by natural processes, leaving an opening through which feces passed from the upper to the lower bowel, a narrow band above alone existing to prevent a freer feculent flow. The success of the operation has been also good; out of forty-one operations recorded by Dupuytren, twenty-nine cases recovered, nine were relieved, three died. In this country the operation has been little practiced.

When a *fecal abscess* has formed in the abdominal walls, the sooner it is opened the better, and when opened the incision should be a free one. In abscesses connected with the *cæcum* or its *appendage* this rule is an important one. For intestinal fistula opening indirectly into the *vagina* little surgically can be done beyond attending to the general condition of the patient, giving nutritious food, but not such as is likely to distend the bowel, and observing perfect cleanliness of the passage, increasing the external

opening should anything like retained pus exist. Under these circumstances a natural recovery may take place. In recto-vaginal fistulæ plastic operations are most successful.

When the *bowel* has ulcerated into the *bladder* natural processes appear to be rarely capable of effecting a cure, and, under such circumstances, to save the patient from the miseries which the passage of solid fæces into the bladder causes, the operation of colotomy may be entertained. I have performed this operation on four occasions with success, the operation in all giving great relief. Two of my patients are now alive free from all pain. The operation was performed in one case on August 16th, 1869, the second on July 5th, 1870 ("Clin. Soc.," 1872). The third died from some disease in the kidneys some months after the operation ("Med.-Chir. Rev.," 1869). The fourth died some weeks after from the cancerous affection for which the operation was demanded, but free from all pain. The patients now living suffer but little inconvenience from the anus in the loin, and no pain from the bladder.

Foreign Bodies in the Stomach and Intestines.—Foreign bodies are often taken into the stomach both from accident and design. They as often as not are passed per anum without giving rise to very distressing symptoms; but when retained they produce nothing but evil. *Smooth hard bodies* such as coins and stones, as a rule, pass readily without giving rise to any symptoms or to other than slight colic. But *sharp* and *pointed bodies* such as bones, pins, knives, &c., give rise to symptoms that vary according to the position of the intestine at which they become impacted.

At times intestinal calculi form, from the agglomeration of hair, husk, particularly oat husks, or other foreign substance, and prove fatal. Dr. Down has recorded such a case ("Path. Trans.," 1867), in a boy, æt. 13, who died of exhaustion after fifteen days' illness. Not many years ago I saw an artist, æt. 36, who died from intestinal obstruction, through whose abdominal walls a globular indurated mass was readily felt on the right of the umbilicus. I suspected it to be made up of hair, for he was in the habit of sucking to an excess the paint brushes of his pupils, but the diagnosis could not be verified after death. A foreign body taken into the stomach may be ejected by vomiting, retained in the stomach, or passed onwards. When retained it may rest there without giving rise to very serious symptoms—a rare result—or set up ulceration, which may in its turn give rise to a fatal peritonitis. In the more fortunate cases it will be passed on through the canal and discharged.

To prove these points the reader may refer to Mr. Pollock's article in "Holmes's System," vol. ii, where he gives a case in which a lady vomited a gold plate, three-quarters of an inch long, with two false teeth, after it had been lodged in the œsophagus for nineteen, and in the stomach for ninety-seven days. Another case is that of Mr. Taylor, of Edinburgh, in which a patient *passed per anum*, three days after swallowing it, an artificial plate with six teeth one inch and three quarters long. And a third case is on record in which a lady passed, per anum, a plate two and a quarter inches in diameter, with four teeth, six months after she had swallowed them.

In the Guy's Museum (prep. 1800) there is an enlarged and thickened stomach of a sailor who had swallowed clasp knives. He was æt. 23, and in June, 1799, he swallowed four clasp knives; these were discharged from the bowels. In March, 1805, he swallowed from fifteen to twenty more. His health became impaired. He vomited the handle of one and passed portions of the blades of others. In March, 1809, he died in a state of exhaustion. After death one blade was found perforating the colon opposite

the kidneys, but without extravasation of fæces. Another was fixed across the rectum; in the stomach were numerous blades partially dissolved—thirty or forty fragments in all.

Poland has also recorded in his prize essay the case of a lunatic who died from ulceration of the duodenum due to the pressure of a spoon handle that had been swallowed three months or more before, with *thirty* others, along with nails, pebbles and pieces of iron, extracted from the stomach after death, and weighing in all forty ounces.

TREATMENT.—When a foreign body of moderate dimensions has been swallowed the usual practice is to give a purge; but it is, however, a wrong one. The “smasher” who constantly swallows false coin, when caught in the act of passing it, according to Pollock, avoids *purgatives*, but takes a constipating diet, such as hard-boiled eggs and cheese, together with his usual food, thinking that the money is more likely to be caught and consequently passed in a bulky stool than in a liquid one. The surgeon should act on this principle. When the foreign body becomes impacted, whether in the stomach or intestine, or sets up by its presence an inflammatory action and peritonitis, the surgeon may entertain the thought of opening the abdomen; that is, he may assist natural processes when these are doing their best to get rid of the foreign substances by ulceration. When the foreign body is large and clearly cannot be passed, the surgeon would also be quite justified in opening the stomach by *gastrotomy*, at least seven cases being on record in which success has followed this proceeding.

The Operation of Gastrotomy.—This operation, except for the removal of a foreign body, is one of expediency. It is performed to prolong life rather than to save it, but how far this prolongation may reach is not yet decided. That the operation is not necessarily fatal is proved by the fact that it has been performed at least seven times for the removal of foreign bodies from the stomach, and in all with success. It has been performed ten times for disease; the longest period a patient survived it being thirteen days. But it is to be remembered that it is proposed only as a means of prolonging life—as one of mitigating the horrors of a death by starvation, and of making easy the days that remain. The arguments in its favor are only such as can be adduced for any other operation having the same purpose. I have had an opportunity of watching the progress of three cases under the care of my colleagues, Messrs. Cooper Forster and Durham, and of one under my own care; and I am free to confess that the advantages given by the operation were worth the risk, and that if life was not prolonged it was certainly rendered more endurable.

We perform colotomy for a patient with cancerous stricture of the intestine or other mechanical obstruction without hesitation; and surgeons are now willing to admit the great advantages afforded by this measure. Surely the advantages offered by gastrotomy for stricture of the œsophagus, cancerous or otherwise, are not less potent, and *should it be undertaken before the patient's powers have been brought to too low an ebb*, there is no reason why it should not be equally effective. In my own case the man lived five days; the operation had nothing to do with the death, and the local repair was most complete. The operation has not been hitherto successful, I believe, because it has been put off until too late a period; in the same way as colotomy was unsuccessful till it was undertaken at an earlier stage of the disease. Let gastrotomy have the same chance as colotomy has now had, and it will become as established an operation in surgery.

The Operation.—Chloroform had better be given, as it is important that absolute quiet be maintained during the operation, although the risks of vomiting as a consequence are not slight. The patient should be placed

upon his back, and an incision made below the ribs on the left side, the object of the surgeon being to find the cardiac end of the stomach in preference to the pyloric. The line of the linea semilunaris is the ordinary one that has been used for the incision, a cut three or four inches long being made carefully through the tissues seriatim down to the fascia lining the muscles, every vessel being twisted or tied as it bleeds. In my own operation I made an oblique incision along the lower borders of the ribs, commencing at the linea semilunaris, with the view of catching the cardiac end of the stomach, and I may say that I picked the stomach up with my fingers very readily; the fascia and peritoneum are then to be divided. With the thumb and finger the stomach is now to be sought, and when caught, held. This is best effected by the passage of a needle armed with a double silk through its coats, the silk being left with long ends; a second should also be passed about three-quarters of an inch lower down. The surgeon has then to fasten the stomach to the margins of the wound, and the quill suture seems to be the best means to use. To do this he may first pass the needles that have already traversed the stomach, and are still armed, through one side of the wound, and with a second needle draw the free ends of the ligatures, when threaded, through the other. The stomach should then be opened over the ligatures that have been passed through it, the incision being made in the line of the wound; the centre of the double ligatures will then be exposed, and these should be drawn well out and divided. There will then be two double ligatures through each side of the opening in the stomach and the margin of the wound. On tying the two ends over two pieces of bougie, one introduced against the inner surface of the stomach, and the other upon the integument, the parts are secured, the bougies admirably compressing the thin walls of the stomach against the integuments, and retaining them there. One or two other sutures will probably be required to close the wound, and an additional one at either end of the opening in the stomach to keep it in its place; the operation is then completed. When the quill suture is not used, the stomach must be stitched to the margins of the wound in the ordinary way, but a more accurate adaptation of the parts and greater security is acquired by the quill suture than any other, and what is more, the pieces of bougie are capital guides to the orifice into the stomach, the slightest traction upon them rendering it patent for purposes of feeding; for this purpose one of the sutures should be left long on either lip of the wound. After the operation it is well to desist from giving food for a few hours, to give the stomach rest. Where enemata can be tolerated they should be used. After a day or so, according to circumstances, liquid nourishment should be administered in small quantities through a tube, milk and eggs being probably the best, or milk alone. Care should be observed that too much food is not given, as it retards progress, a quart or three pints of milk in twenty-four hours being ample. The edges of the wound should be carefully protected by oiled lint. The sutures may probably be removed wholly or in part on the fifth or sixth day.

It must be added that Sédillot was the first surgeon to perform the operation, and Mr. Cooper Forster, on the suggestion of Dr. Habershon, was the first to do it in this country in 1857. Since then Mr. Sydney Jones, Fenger, of Copenhagen, Mr. Durham, and myself, have had cases. Mr. Durham, in "Holmes's Surgery," vol. ii, ed. 2d, gives a table of all these cases, with the exception of my own, with references.

When a foreign body becomes *impacted in the small intestine*, and life is threatened, it is a question how far the surgeon is justified in attempting its removal. I can see no reason why an attempt should not be made, when

the course of the case has proved that natural processes are incompetent to get rid of the offending body, and life is threatened by its presence.

When the *cæcum* or its *appendage* are the seat of the impaction there is less objection to the attempt, for the cases of suppuration about the *cæcum* that occasionally are met with are successfully treated by free incisions in the iliac fossa, and when caused by the presence of a foreign body, they are not less likely to prove of use.

When the colon is the seat of obstruction from such a cause, *colotomy* may certainly be performed, for it is now known to be a valuable operation for cancerous obstruction of the rectum, and for simple or mechanical obstruction it is of equal value. Mr. Clement's case ("Med.-Chir. Trans.," vol. xxxv), in which he performed colotomy in the right loin for intestinal obstruction, is a case in point.

Intestinal Obstruction—from other causes than the impaction of foreign bodies—occasionally demands the attention of the surgeon, and there is no class of cases that calls for more thought and judgment; for the question of operative relief has to be decided upon very questionable grounds, and it is yet an open question as to whether the procedure be admissible.

For intussusception and strictures of the small intestine there is little to be said in favor of operative interference, although Mr. Hutchinson was led to open the abdomen of a child where the symptoms of intussusception were very marked on the tenth day, and to draw out the invaginated bowel with a successful issue; the cause of obstruction in such cases is *within* the intestines themselves, and not outside. They are mostly—except in their very earliest stage, when their diagnosis is obscure—irremediable by surgical art. But for *internal strangulations*, in which the bowel is obstructed by some solitary band, omental, mesenteric, or otherwise, the same cannot be said; for, granting that a diagnosis of a case can be made, and its almost certain fatal termination accepted, the question of operation becomes a simple one—for the cause is without the bowel and remediable—ought the operation to be attempted, or is the patient to be left to die unrelieved? I have no hesitation in giving it as my opinion that an operation is justifiable under these circumstances, but only when the diagnosis is fairly clear.

These cases are not uncommon. Dr. Fagge, in an able article on the subject of intestinal obstruction ("Guy's Hosp. Rep.," 1868), remarks that out of 75 fatal cases of intestinal obstruction at Guy's, in fifteen years, 17, or about one-fifth, were of this nature. Dr. Brinton found that out of 600 cases of intestinal obstruction, 31 per cent. were from bands, 43 from intussusception, 17 from stricture, and 8 from torsion; and in most of these it might be said that surgical relief could have been given. There might, says Dr. Fagge, "in many cases have been no little difficulty in finding a band among the distended coils, but I regard the facts derivable from our post-mortem records as indicating no insurmountable obstacles to the success of an exploratory operation in the great majority of the cases of true internal strangulation, which are to be found in these records."

We come now to the question of diagnosis, and it must at once be admitted that in many instances of obstructed bowel, as they come under the notice of the surgeon, it is impossible to make out their true nature, but in as many more the indications are not uncertain. The following are tolerably characteristic of the presence of a band:

"The sudden and definite onset of the patient's illness; the occurrence of collapse at its commencement; the comparatively early age; the severity of the pain, which is generally referred to the umbilicus; the absence of a hernia, obturator or otherwise; the absence of any precursory symptoms; the absence of tumor, hemorrhage, and dysenteric symptoms, such as are

seen in intussusception; and the absence of that extreme intensity and rapidity which belong to the more acute form of *volvulus*.”—FAGGE.

When there has been a history of an old hernia, the probabilities of the existence of a band are much enhanced, for it is true that with hernia such bands are not uncommon. Duchaussoy, in his paper “On Internal Strangulation” (“*Mem. de l’Acad. de Med.*,” 1860), gives such cases. Fagge quotes one, and in my own practice three have occurred: one died unrelieved; in the second I opened the empty hernial sac, and so enlarged my incision upwards for about two inches as to detect a band high up in the abdomen, this I divided with a pair of scissors, and a perfect recovery took place. The case occurred in the practice of Dr. Wilkinson, of Sydenham, and is fully recorded in the “*Med.-Chir. Trans.*” for 1867. The patient is still alive. The third died after the operation, but the band was divided, and a large coil of intestine released. The operation had been put off too long.

“If, then, we are called to see a patient under thirty years of age, who has been suffering for four or five days with symptoms of obstructed bowel, constipation, vomiting of intestinal fluid, distension of the abdomen, and mapping out of coils on its surface, and who has collapse, scanty or suppressed urine, and severe *paroxysmal* pain, referred to the umbilicus or to the right iliac fossa, which pain came on suddenly at a definite time, perhaps after the patient had made some effort or received a blow; if before this the patient had been healthy, if no tumor can be felt, and there has been no tenesmus nor internal hemorrhage; and lastly, if the distension of the abdomen, although marked, be not excessive, under such circumstances we should be justified in treating the case as one of internal strangulation.”—FAGGE.

Mr. Gay also, in two valuable papers published in the “*Trans. of the Med. Soc. of London*,” 1861–2, gives an analysis of 148 cases of strangulation by the “*solitary band*.” One hundred and two were in the male, forty-eight in the female; the largest number took place between the ages of 15 and 35; “but these bands may form at any period of life, and when once formed they may prove fatal by entangling some portion of intestine at any period up to the latest.”

He gives also seventy-four cases of “*invagination*” of the intestine; in thirty-three the small intestine was the seat of trouble; in thirty-three the small intestine, with or without cæcum or colon, was invaginated into the colon; in eight the large intestine was alone involved. The youngest patient was a child one year old, and this was of the small intestine alone. Intussusception in children, however, as a rule, involves the lower part of the ileum, cæcum, and colon.

In both obstruction by “band” and “invagination” the attack is generally sudden. When by a band pain is fixed from the first, and paroxysmal, it remains severe to the last. When from invagination pain varies much both in seat and intensity; it is often relieved by pressure; towards the last pain ceases.

In “band,” vomiting soon becomes fecal, and is constant; in intussusception it may be the same, but it as often ceases.

In “band,” constipation is the rule; in invagination, diarrhœa, tenesmus and bloody mucoid stools are characteristic; they are not, however, constant, as constipation is at times present.

In “band,” abdominal distension is an early symptom; in “intussusception,” it may never exist. In the latter also a distinct tumor may be felt.

In Intussusception the proper treatment appears to be that of *inflation*.

Gorham recommended this treatment years ago, and more recently, good success has followed the practice.

In intussusception and in strangulation from a band, *opium* should be freely given from the first, and chloroform at an early stage of this affection may tend towards recovery. *Inversion* of the body has been advised with the chance that the weight of the contents of the bowel above the invaginated or obstructed segment may suffice to disengage it. *Operation* in intussusception is scarcely justifiable. In the very early stage it might do good before the invaginated bowel has become adherent, and Gay tells us that this does not take place for four or five days after the first symptoms, and may not for ten. But in this early period the diagnosis is too uncertain to allow of such a proceeding, and the chances of a natural cure have not passed.

For not only do cases of intussusception occur and pass on to a natural cure by the bowel freeing itself, but in many the invaginated portion sloughs away, and a cure results. Mr. Gay, however, thinks that "when the evidence is complete, and the age is so far advanced that there is a reasonable prospect of the individual surviving the shock of such an operation, gastrotomy should be performed, and Hutchinson's case is certainly encouraging."

Operation.—The abdomen should be opened near the seat of pain. If an old hernia exists the sac should be explored, and the abdominal incision made upwards from its neck; where no such indication exists, the opening may be made in one or other of the lineæ semilunares, as suggested by the symptoms, and all vessels secured as divided. The abdomen should at first be explored by the finger, and more particularly towards the umbilicus, for it seems that bands are more often found opposite the promontory of the sacrum than anywhere else. Should the finger fail to find out the cause, the opening must be increased and the parts inspected, and, when possible, the cause of the symptoms should be removed. The wound should be carefully adjusted by stitches. After the operation the patient should be kept under the influence of opium or morphia, the morphia suppository every five hours being the best form to use. Milk diet should be given in small quantities, and, if recovery is to follow, it will probably be speedy; for repair rapidly takes place in all abdominal sections when a case goes on well, and death speedily ensues when the reverse.

On Tapping the Intestine.—The practice of tapping the intestine with a fine trocar and canula, in these cases, is one which deserves serious consideration, for there is good reason to believe that a small puncture may be made into a distended intestine, and wind drawn off without any extravasation of the contents of the bowel taking place, and that the distension of the strangulated, twisted, or otherwise obstructed bowel, can be relieved by the operation; under such circumstances there is reasonable room for hope that natural efforts may then release the bowel from beneath its band, or from some internal peritoneal ring, or even that a twisted bowel may untwist. I have been led to think, also, that even in a large hernia its strangulation might be relieved by a like operation and a natural reduction take place; for a strangulated bowel, outside as well as inside the abdominal cavity, is as much strangulated by the distension of the intestine as from any external intestinal influence, and if this distension can be relieved by simply drawing off its flatulent contents by means of a very fine trocar and canula, the walls of the intestine would collapse, strangulation would cease, and unless adhesions confined the bowel in its position, its return might be looked for by natural efforts. These remarks are based upon the fact that intestine may be so treated without any extravasation following, and this fact

came before me in a case of ileo-colic scrotal hernia, in a gentleman, æt. 76, in which, to enable me to reduce the bowel, I was driven to puncture the protruding intestine in four or five places, and although much manipulation followed this practice, no extravasation occurred at the time or after, for a rapid recovery took place without a drop of suppuration. The case was one which occurred in the practice of Mr. Kelson Wright, of Kennington. These remarks are only to be read as suggestions, and more particularly as applied to large umbilical and scrotal herniæ. For more detailed evidence upon this subject of intestinal obstruction and its treatment, the following papers may be referred to:

Brinton, "Croonian Lectures," 1859.—*Fagge*, "Guy's Reports," 1868.—*Gay*, "Trans. Lond. Med. Soc.," 1861-2.—*Gorham*, "Guy's Reports," vol. i.—*Hinton*, "Association Med. Journal," 1853.—*Smith*, "American Journal of Med. Science," 1862.—*Bryant*, "Med. Times," 1872.

On Tapping the Abdomen.—Whenever fluid so collects in the abdominal cavity as to interfere with life's functions, the operation of tapping may be called for. It may be for *ascites*, a collection of fluid in the peritoneal cavity; for *ovarian dropsy*, a collection of fluid in a single or in a polycystic tumor; or for *hydatid*, whether hepatic, pelvic, or peritoneal. It may also be called for in *renal* or *splenic* cysts.

It would be out of my province to enter minutely into the diagnosis of all these conditions, for the majority of such cases come under the care of the physician, the surgeon being called in simply to act. Nevertheless, it will be as well to give some of the leading points of diagnosis, for I need hardly say that the operating surgeon is not relieved of all responsibility of diagnosis by the fact that a medical mind has charge of the case; he is to be the operator, and as such assumes part, at least, of the responsibility of the case as well as of the operation.

Diagnosis.—In a general way it may, therefore, be asserted that *ascites* is the result of a chronic action that has been going on for some time, it may be from liver disease, peritoneal disease, heart disease, or renal disease, the abdominal dropsy being one of the results only. The history of the case will consequently be a great help in coming to a conclusion. The fluid will moreover, be found to fill the abdominal cavity equally; fluctuation being perceptible across the abdomen, and from before backwards well into the loins, even when resonant. As a rule the intestines will be found floating upwards, thus giving resonance on percussion, the position of the bowels being influenced by the position of the patient. With the body horizontal they will give resonance at the umbilicus, with the pelvis depressed, above this point; with the pelvis well raised resonance may even be felt near the pubes. In almost all these cases the loins will be dull. On looking at the abdomen the surface will be smooth and the enlargement equal.

In Ovarian Dropsy the history of the case will generally only tell of a gradual, and it may be a painless, abdominal enlargement. At times the swelling will have been made out to have commenced at one side, but this is not usual. The *general health* of the patient will probably be good; beyond the abdominal enlargement there will be a total absence of symptoms of any such abdominal disease as usually precedes ascites. There will be more or less distinct *fluctuation*, according to the nature of the disease; where one large thin cyst exists, the fluctuation will be as distinct as it is in ascites, and the two will be indistinguishable; where many cysts exist, their outline may be made out, and fluctuation will be modified. On *looking* at the abdomen also some irregularity in the outline of the swelling will usually be visible; some bulging in one or other direction. On *per-*

ussion dulness will probably be found over the whole anterior aspect of the abdomen. Above the umbilicus there will probably be resonance, and in the loins resonance is a very constant symptom. This dulness over the lower part of the abdomen will also not be modified by any elevation of the pelvis, for an ovarian tumor must be small indeed that will allow of intestines so to rise over it as to give resonance on percussion. A pelvic examination in ovarian dropsy, amongst many things, gives evidence of the cystic nature of the growth, and where the uterus is drawn upwards the pelvic origin of the growth is rendered probable. In ascites the uterus is generally pressed downwards, and where much fluid is present the pelvic peritoneal pouches usually project well into the vagina.

Hydatid Tumors, however large, rarely produce other symptoms than those mechanically caused by their size. Their origin is indicated by their position, although when situated in the pelvis there may be an impossibility of diagnosing them from ovarian cysts. They are almost always very globular and tense. They rarely give rise to distinct fluctuation. The external feel of a hydatid is somewhat peculiar and characteristic. In 1868 I removed, with permanent success, an enormous hydatid tumor from the abdomen, although apparently not from its cavity, of a lady patient of Dr. Oldham, æt. 35, who was believed to have had ovarian disease ("Guy's Hosp. Rep.," 1868), and recently Mr. Spencer Wells has recorded a case in which the hydatids were turned out of the abdominal cavity. In every case of tapping the surgeon should also bear in mind that fibro-cystic disease of the uterus may so enlarge the abdomen as to simulate ovarian dropsy in its most solid form, and ask for some relief, and that a pregnant uterus has been mistaken for ovarian disease. Under all circumstances the condition of the bladder should be inquired into.

The Operation.—The instruments required for the operation are a moderate-sized trocar and canula; an india-rubber tube about four feet long, adapted to a silver tubular plug that fits the canula when the trocar is removed; a lancet or small scalpel; a pad of lint; and a roll of good strapping.

Some surgeons prefer one of the modern instruments, by which the india-rubber tube is attached to the canula at right angles, and they are very good; but the instruments I have named are ample.

The patient, in the recumbent position, with the shoulders raised for comfort, should be brought to the edge of the bed, a folded sheet or piece of mackintosh cloth having been previously so arranged as to protect the sheets. With the trocar and canula warmed and oiled, and a pail at hand, into which the end of the india-rubber tube is allowed to hang, the surgeon may then with a lancet make a small incision through the skin and soft parts, about three inches below the umbilicus, or at any other spot at which the operation is to be performed, subsequently introducing the trocar and canula with a direct force and semi-rotatory movement of the wrist, and guarding, with his forefinger fixed about one inch from the end of the canula, against inserting the trocar too far. The abdomen having been punctured, the trocar may be removed with the right hand, the canula being pushed further in at the same moment with the thumb, and its orifice plugged at once with the left thumb, to prevent the escape of fluid. The silver plug of the india-rubber tube may then be introduced and the fluid allowed to escape.

To facilitate the flow and to evacuate the whole contents of the cavity some surgeons roll the patient over on the side, or place him so at the first; but such a proceeding is not necessary.

When the fluid has ceased to flow the canula is to be gently removed, the thumb and finger of the left hand nipping up the soft parts as its end appears, thus preventing any fluid trickling down the patient. The edges may then be adapted by a piece of good strapping, a pad of lint applied when oozing appears, but not otherwise, and two or three broad bands of strapping, three inches wide, carefully adjusted to the front of the abdomen from side to side. Where great hollowness is left, a good pad of cotton-wool often gives comfort; but the old-fashioned flannel bandage may be abolished, it is only an inconvenience.

All pressure on the abdomen during the flow of the fluid should be avoided, as being unnecessary and also all pressure after the operation; support only is required.

The usual place to perform the operation is about two or three inches below the umbilicus in the linea alba; but in ovarian disease any point in the linea semilunaris may be used, and in rare cases any other.

When a hydatid or other renal or splenic cyst requires to be tapped a small trocar and canula should be used, such as is employed for tapping a hydrocele; but in these cases the modern instrument called the Pneumatic Aspirator is of great service, for by its use every drop of fluid can be removed without the possibility of any air being introduced. It is simply an exhausting air-syringe with a double tap for ingress and egress of the fluid, the taps being so made as to fit into a hollow trocar. As improved by Weiss it is a valuable instrument.

The operator having attached the short elastic tube (D) to the bottom tap (A) and the long one (C) to the upper tap (B), creates a vacuum in the aspirator in the following manner:

1. Hold the syringe with the glass tube (E) downwards, and close both taps (A and B).
2. Screw up the piston by turning the handle to the right.

For diagnosis, insert one of the fine needles a little way beyond the two eyes, near its point, and attach the free end of the short elastic tube (D) to it.

Open the lower tap, and further introduce the needle, until the fluid is seen to flow through the short glass tube (F) into the body of the syringe. The fact of the latter being filled is indicated by the long glass side tube (B). To empty the syringe, close the lower and open the upper tap, and screw down the piston. Before a vacuum is again created in the syringe, the upper tap (B) must be closed.

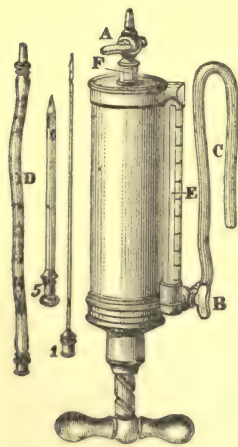
The presence of fluid having been established by the use of one of the fine needles (No. 1); it is recommended for more quickly emptying the cyst to use one of the larger needles or trocars; No. 5 being the largest.

The needle should be introduced with pressure and rotation.

Hydatid Tumors of the liver, spleen, or other parts of the abdomen are occasionally met with, and from the mechanical inconvenience they cause, require treatment. Sometimes they die without surgical interference, and as a consequence severe suppuration is set up with violent constitutional disturbance, for which surgical aid is called for.

Not long since I opened a large abscess over the liver of a boy æt. 17,

FIG. 160.



and evacuated a quantity of pus bearing the peculiar odor of hydatid pus, with marked benefit. The abscess clearly came from the liver, and was a suppurating hydatid. The boy previously had suffered from tapeworms. In 1869, I had to open freely a suppurating hydatid tumor, which half filled the abdomen of a gentleman, *æt.* 40, who had had it tapped some months before in Australia, and a complete recovery ensued. A quantity of dead hydatid cysts escaped through a large canula that was introduced. The cyst was washed out daily with great benefit. This gentleman is now quite well. I have had three or four other cases in which a like treatment was employed with success. I have not lost one, although several have had a very narrow escape. The secret, I take it, of the treatment of suppurating hydatid cysts consists in a free outlet for all purulent and dead hydatid deposits, and the frequent washing out of the suppurating cavity with water containing iodine, Condy's fluid, or creasote, with or without the introduction of a drainage-tube or elastic catheter.

For the operation, a large trocar and canula should be employed, the canula being left in for some days until a good opening is established; it may then be removed for an elastic catheter or large drainage-tube.

Before suppuration, however, takes place other treatment is applicable, such as simply draining off the fluid contents of the hydatid by means of a very fine trocar and canula. I have done this on four occasions, and in each a permanent cure followed. At times, however, this operation kills the hydatid, and is followed by suppuration. My colleagues, Dr. Fagge and Mr. Durham, have given us good evidence that a cure may be obtained by electrolytic treatment, on Dr. Altham's plan of introducing into the tumor two electrolytic needles, one or two inches apart, connected by means of wire to the negative pole of a galvanic battery of ten cells, and completing the current through the tumor by means of a moistened sponge, attached to the positive pole of the battery, applied to different points over the swelling, for ten or more minutes at a time. (*"Med.-Chir. Trans.,"* vol. liv.) This operation may be repeated according to circumstances.

This plan of treatment is one which should certainly be employed when simple tapping fails to cure.

For further information refer to Murchison's work on the liver, 1868, and Harley's paper, *"Med.-Chir. Trans.,"* vol. xlix.

CHAPTER XXXII.

HERNIA.

DIAGRAMS ILLUSTRATING THE DIFFERENT FORMS OF HERNIA, WITH SOME OF ITS COMPLICATIONS.

IN all the thick black line represents the parietes covering in the hernial sac; the thin line the peritoneum and hernial sac; the small body at the bottom of the sac the testicle.

FIG. 161.



FIG. 162.



FIG. 163.



FIG. 164.



FIG. 165.



FIG. 161.—This diagram illustrates the tubular vaginal process of peritoneum open down to the testicle, into which a hernia may descend; when the descent occurs at birth it is called "congenital;" when at a later period of life the "congenital form" of hernia, Birkett's "hernia into the vaginal process of peritoneum," or Malgaigne's "hernia of infancy."

FIG. 162.—The same process of peritoneum open half way down the cord, into which a hernia may descend at birth or at a later period. Birkett's "hernia into the funicular portion of the vaginal process of the peritoneum."

FIG. 163.—The same process undergoing natural contraction above the testicle, explaining the hour-glass contraction met with in the congenital form of scrotal hernia as well as in hydrocele.

FIG. 164.—Diagram showing the formation of the "acquired congenital form of hernia," the "encysted of Sir A. Cooper," "the infantile of Hey," the acquired hernial sac being pushed into the open tunica vaginalis which incloses it.

FIG. 165.—Diagram illustrating the formation of the "acquired" hernial sac distinct from the testicle or vaginal process of peritoneum which has closed.

FIG. 166.



FIG. 167.



FIG. 168.



FIG. 169.



FIG. 166.—Illustrates the neck of the hernial sac pushed back beneath the abdominal parietes with the strangulated bowel.

FIG. 167.—Shows the space in the subperitoneal connective tissue into which intestine may be pushed through a rupture in the neck of the hernial sac; the intestine being still strangulated by the neck.

FIG. 168.—Diagram showing how the neck of the vaginal process may be so stretched into a sac placed between the tissues of the abdominal walls either upwards or downwards between the skin and muscles—muscles themselves or between the muscles and the internal abdominal fascia—forming the intra-parietal, intermuscular, or interstitial sac; hernia *en bissac* of the French; "additional sac" of Birkett.

FIG. 169.—Diagram illustrating the reduction of the sac of a femoral hernia *en masse* with the strangulated intestine.

ABDOMINAL HERNIA.

Abdominal Hernia or Rupture signifies the protrusion of any viscus from the abdominal cavity; this protrusion for the most part occurring at the *inguinal* and *femoral* canals or *umbilicus*; occasionally at other parts of the abdominal walls, when they have been weakened by some inflammatory lesion, rupture, or division of muscle from injury or operation, and more rarely at such weak points of the abdominal walls as the obturator foramen, the perineum, the ischiatic notch or the vagina.

It is met with in subjects of every social condition, but most frequently amongst the so-called working classes; and probably as Mr. Kingdon tells us in his excellent paper on hernia ("Med.-Chir. Trans.," 1864) because "hernia occurs oftenest in the most numerous classes, and not in the most laborious."

Hereditary predisposition to hernia is also doubtless a reality; a third of all cases acknowledging a history of having a ruptured parent; and I have recently been called upon to operate on an old gentleman, the male branches of whose family for four generations—twelve in all—have been ruptured, this predisposition probably existing as a general laxity of the mesenteric folds and parietal layer of peritoneum, and in inguinal hernia often as a failure in the natural closure of the sheath of peritoneum that travels down with the descending testicle, this failure being more common on the right side.

Subjects who are congenitally feeble and others who become so from illness or old age are more prone to the appearance of a hernia than the robust, the weakness of the abdominal parietes yielding to the natural pressure of the abdominal contents under the influence of some sudden or prolonged muscular exertion. Although a large number of the cases of hernia are slow in their development, many are sudden, and in all, muscular exertion plays an important part.

Out of every 100 cases of hernia, 84 are *inguinal*, 10 *femoral*, and 5 *umbilical*. Hernia is more common in males than females, in the proportion of 4 to 1; 18,492 females only having been applicants for trusses at the Truss Society, out of the total of 96,886 ("Report," 1861).

Females are as liable to inguinal hernia as they are to femoral, the inguinal being most common in early life, from the canal of Nuck being open; the femoral in middle and old age. In females under 20 years of age there are 87 cases of inguinal hernia to 13 of femoral; over 40 years of age there are 32 cases of inguinal to 68 of femoral, the largest number of cases of femoral hernia being developed during the childbearing period of a woman's life, between 20 and 40 years of age. Before menstruation it is so rare as to be almost unknown. Kingdon gives only four such cases.

In males *inguinal* hernia is the usual form, Kingdon's table showing that the largest number of cases occur during the first ten years of life, in consequence of the vaginal process of peritoneum that covers the spermatic cord being still open; that between 10 and 20 years of age it is about half as frequent, between 20 and 40 it is as common as it is at the early period of life, and that after that period its frequency rapidly diminishes.

Femoral hernia in the male occurs about four times in a hundred, but during the first ten years of life not more than once in 300; between the ages of 10 and 20 two per cent. are femoral; between 21 and 40, $4\frac{1}{2}$ per cent.; between 41 and 60, 6 per cent.; above 60 nearly 8 per cent. Femoral hernia in the male as in the female becomes relatively more common than inguinal as age advances.

The average age of persons suffering from *strangulated inguinal hernia* is 43, from femoral 55. Of cases of "recent hernia" in which strangulation takes place on its first descent three-fourths are femoral, and they are generally in subjects about 60 years of age. Recent cases of strangulated inguinal hernia are mostly in young adults, and of the "congenital kind." "Recent" cases of strangulated hernia are far more acute and fatal than those of long standing.

A *hernial tumor* is usually composed of a *sac* with its *contents*, and the soft parts covering it.

When the *sac* exists it is always made up of peritoneum; it is formed by the gradual stretching and pouching of this membrane through an opening in the abdominal parietes by the protruding viscera, and being thus artificial has been well named by Birkett the *acquired hernial sac*. This term is applied to distinguish it from a second form—equally well named—the *congenital hernial sac*, which is found only in inguinal hernia, and is composed of the vaginal tubular process of peritoneum formed by the descent of the testicle; the opening that normally exists in foetal life not having closed from some deficiency in the obliterating process that naturally commences at the internal ring, and proceeds downwards towards the testis in the descent of the organ into the scrotum.

The formation of the hernia in the former case is a gradual process, in the latter a rapid one, the "acquired" hernia being an affection of middle and old age, the "congenital form" one of infancy or young adult life. The *sac* also is composed of a body and a neck, the neck communicating by a mouth with the abdominal cavity.

When the hernia is small, the neck and body appear as a small pouch, the hernial contents passing in and out with facility, the *sac* having no narrow neck by which the return of the intestine can be retarded; but when it becomes large by escaping into looser tissues, and the body of the *sac* or fundus so expands as to render by comparison the neck of the *sac* a narrow canal or orifice, the return of the hernial contents often becomes one of difficulty, and under these circumstances its strangulation frequently occurs.

The neck of the *sac* also undergoes changes which it is essential to understand. In a small hernia, as already stated, the neck and body appear as a small pouch; but in a large one, where a large extent of peritoneum has been forced outwards through the ring that surrounds the neck, the membrane thus drawn together naturally falls into folds, and becomes more or less puckered according to the size of the neck and that of the tumor.

Should this hernia and *sac* be reduced into the abdominal cavity, all these folds will disappear, and should the constricting ring of tissue external to it be divided, the same result will ensue, the amount of unfolding of the neck of the *sac* being regulated by the extent of expansion of which it is capable. Should the *sac* be neither returned nor its constricting outside ring divided, the puckered folds of peritoneum will adhere together, the subperitoneal connective tissue probably becoming connected with it; the neck of the *sac*, instead of presenting a puckered aspect capable of becoming free, will indurate and thicken, so that in an old hernia, and particularly if it be inguinal, the neck of the *sac* has an independent existence, and requires in operation special treatment, this fact explaining why it generally happens that in an old inguinal hernia the *sac* has to be opened and its neck divided, when an operation for strangulation is required.

This thickening, moreover, as time progresses, is followed by contraction, the neck of the *sac* consequently becoming narrower as it becomes less elastic, and adding another difficulty to the reduction of the hernial contents.

When a hernia forms at the seat of a wound in the abdominal cavity there is no sac, and the same occurs when the cæcum or colon protrudes through the inguinal canal.

The *contents* of a hernia are usually small intestine and omentum, a portion of the last two feet of ileum being, as a rule, involved; the cæcum and colon are occasionally so, and cases are on record in which the bladder, stomach, or ovary, have been found in the sac.

At times the omentum is so pushed before the intestine as to cover it completely, thus forming an inner sac; as a rule, the bowel is behind the omentum.

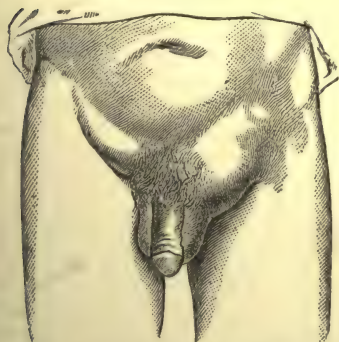
When intestine protrudes, the hernia is called an *enterocele*; when omentum, *epiplocele*; when both intestine and omentum occupy the sac, *entero-epiplocele*; when bladder, *cystocele*; when stomach, *gastrocele*, &c., &c.

The *soft parts covering in a hernial sac* will necessarily depend upon the seat of the hernia. Thus, in the *umbilical*, it may be only skin and abdominal fascia; in the *scrotal*, it will be the scrotal tissues; in the *femoral*, the skin with the superficial and deep fascias; but in all, and more particularly in the femoral, the surgeon should bear in mind the anatomical fact, that a layer of fascia which lines the abdominal muscles and separates them from the peritoneum covers in the true peritoneal sac; it is known as the "fascia propria" of Sir A. Cooper, and between this fascia and sac some subperitoneal fat often exists.

When a hernia comes down into a sac and goes up again, either by itself, or aided by position, or by the surgeon, it is called *reducible*; when it cannot be returned, it is called *irreducible*; when it is constricted sufficiently to interfere with the return of the contents of the protruding viscera and the circulation of the part, it is said to be *strangulated*.

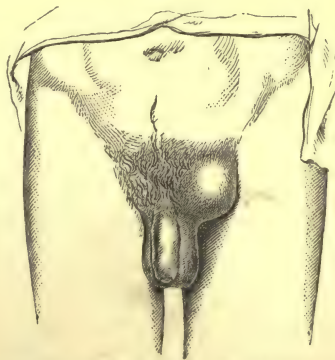
When the protrusion takes place *above* Poupart's ligament, through the internal ring, but does not traverse the canal sufficiently far to appear through the external ring, the hernia is called a *bubonocoele*; *vide* right side of Fig. 170; when it does protrude through the external ring into the scrotum, it is called a *scrotal hernia* (*vide* left side of Fig. 170), both these forms being included in the term *oblique inguinal hernia*.

FIG. 170.



Guy's Hosp. Mus., 478¹³. Oblique inguinal hernia. Bubonocoele on right side, but passing through external ring on left.

FIG. 171.



Guy's Hosp. Mus., 486²⁰. Direct inguinal hernia.

When a hernia makes its way directly through the external ring without having passed down the inguinal canal, it is called a *direct inguinal* (Fig. 171).

A *crural* or *femoral hernia* is *below* Poupart's ligament, the protrusion having come down through the crural ring on the inner side of the sheath of the femoral vessels (Fig. 172).

An *umbilical hernia* or *exomphalos* is a protrusion at the navel. A *ventral* is a protrusion at any other part of the abdomen. The names of every other form are according to the locality.

FIG. 172.



Femoral hernia (from cast). Guy's Hosp. Mus., 318.

Symptoms.—A hernia in its early stage may show itself as a mere *fulness* about the internal inguinal or the crural ring, this fulness becoming very manifest on the patient standing and coughing, and the patient's attention having probably been drawn to the part by a feeling of *weakness* on taking exertion, or in performing any natural act demanding the strong action of the abdominal muscles. With this weakness there is often associated some gripping abdominal pain or feeling of uneasiness wrongly attributed to constipation,

and in old people these symptoms should always attract the notice of the surgeon.

As the hernial pouch becomes larger the tumor increases, a distinct swelling under these circumstances appearing in the inguinal canal, at the femoral ring or umbilicus. This swelling is very clear when the patient stands or coughs; it disappears on lying down, and is prevented only from returning, on the patient assuming the erect posture, by the finger placed over the ring. The swelling always comes from above, and travels downwards. As the tumor still further increases, a distinct impulse will be felt by the hand when placed over it if the patient coughs, and a peculiar gurgling sound will be heard on the application of pressure to the part to cause its reduction. The return of the bowel also into the abdominal cavity will be marked by the disappearance with a jerk of the contents of the sac, and a distinct appreciation by the finger of the aperture through which it has passed.

"If the surface of the tumor be uniform, if it be elastic to the touch, if it become tense and enlarged when the patient is troubled with wind, holds his breath or coughs; if in the latter case it feels as if it were inflated, if the part return with a peculiar noise and pass through the opening at once, the contents of the swelling are *intestine*. If the tumor be compressible, if it feel flabby and uneven on the surface, if it be free from tension under the circumstances just enumerated, if it return without a noise and pass up gradually, the case may be considered an *epiplocele*. If a portion of the contents slip up quickly and with noise, leaving behind something which is less easily reduced, the case is probably an *entero-epiplocele*" (Lawrence).

In infants where Malgaigne's "hernia of infants" exist (Fig. 161), or Haller's "hernia congenita," both being caused by the descent of intestine into the open vaginal process of the peritoneum, the tumor is very often large when first discovered, and often scrotal. In young adults, where the same kind of hernia exists, the swelling comes suddenly and at once, by one rush downwards into the scrotum, this rush being accompanied with pain.

In all these forms of hernia, when reducible, either the *palliative* plan of treatment may be employed, or what is known as the *radical cure*.

The *palliative treatment* consists in the application of a *truss*—an instru-

ment composed of a pad or cushion, connected with a metallic spring or with straps, and so arranged that the pressure of the pad keeps the hernia from descending, and the spring maintains the pad in position, and at the same time allows perfect freedom of movement of the body. Any truss that does this is good; any truss that fails in this is worse than useless; it is injurious, as it gives false confidence.

The operation for the *radical cure* of hernia will be considered under the heading "Inguinal hernia."

Irreducible Hernia.—When the contents of a hernial tumor cannot be returned into the abdominal cavity an irreducible hernia is said to exist, and this condition may be brought about by anything that alters the relations between the bulk of the tumor and the neck of the sac, or opening through which they would have to return; it may be some excess of feces or flatus in the part, or some fresh descent of omentum or bowel.

In older cases some development of fat in the omentum, adhesions between the sac itself and its contents, or the existence of bands traversing the sac may have the same result, as also when the intestine is caught between the folds of omentum.

The structures outside and within the neck of the sac have also an important influence in preventing the reduction of the tumor, such as their tonic or spasmodic contraction under the influence of irritation, and the induration of the neck of the sac itself or of the parts around.

When the cæcum or large intestine forms the contents of the hernia, the rupture may be irreducible from the fact that the peritoneum, which is naturally adherent to these parts and is dragged down with them, becomes fixed to the tissues into which it is protruded. A cæcal hernia is, however, always difficult of reduction. In one case I had to puncture the bowel with a trocar and canula, and draw off the air it contained before I succeeded. No harm followed this step, and the patient did well.

An irreducible hernia is always a source of anxiety and danger, for when composed of omentum a piece of intestine may at any time slip down behind it, and become caught in one of its folds; and when composed of omentum and intestine, any accumulation of the contents of the bowel within the hernial sac may give rise to obstruction, and with this, strangulation of the hernia is not far off. An irreducible hernia, moreover, is always liable to injury.

An irreducible scrotal, or even femoral hernia, will sometimes attain a large size. I have seen specimens of both reaching half way down the thigh. Umbilical hernia will sometimes attain a still larger size.

They often also give rise to dyspeptic symptoms—irregularity of bowels and colicky pains. Their chief danger, however, is their tendency to become strangulated.

TREATMENT.—A large irreducible *entero-epiplocele* must be treated by a bag-truss; that is, with an instrument so adapted as to support the hernia, and prevent as far as possible its increase; a small irreducible hernia should be treated by a hollow truss. An *omental* hernia may be treated by a truss, the pad being made of such a shape as to adapt itself to the neck of the tumor, and of such a substance as to seal the orifice of the sac without causing pain; air, sand, or india-rubber being probably the best material for pads. Every patient with such a hernia should be warned against taking violent exercise, or over-distending the abdominal viscera. The bowels should never be allowed to become constipated, and, above all, the slightest symptom of pain or increase of size in the tumor should be dealt with at once under medical advice; for these irreducible hernias are treacherous things, and become obstructed and strangulated very insidiously.

Obstructed Hernia.—The *symptoms of an obstructed hernia* are not very definite. Obscure abdominal pains, with a dragging sensation about the umbilicus after food, nausea, and at times vomiting, are the chief. Constipation, when present, always aggravates the symptoms, and renders the *local signs* of obstructed hernia more marked, for under these circumstances the tumor becomes distended, tympanitic, and painful. On manipulation, however, the intestine in the hernia may be partially or wholly emptied of their gaseous if not of their solid contents, the compression of the tumor being accompanied by the peculiar gurgling sound of gas and fluid as these traverse the canal towards the abdominal cavity. These cases of obstructed hernia, however, if unrelieved, may become inflamed. When these symptoms are chronic they are generally known as indicating an *incarcerated hernia*, but such a term is not satisfactory; it has been applied to different conditions, to the obstructed and the irreducible, and it had better be discontinued.

TREATMENT.—These cases require great care in their treatment, for if neglected, they pass on rapidly to inflammation or strangulation. *Rest* in the horizontal position is of primary importance, with some slight elevation of the tumor should it be scrotal. *Warmth* to the hernia, also, often gives comfort, relaxing the parts, and thus favoring reduction.

When constipation exists, *unaccompanied by vomiting*, a brisk purge may be given, but with this symptom of obstruction a purgative enema should be preferred. By these means the natural action of the bowels is stimulated, and the contents of the hernial sac are moved on. The tumor itself, at this stage of the case, should not be manipulated. Such a step cannot but do harm, by bruising or setting up inflammatory action. Should success not attend these efforts, and the symptoms persist, the source of obstruction will have to be sought by the surgeon—for it will probably be mechanical—and the case dealt with as one of strangulated hernia.

Under certain circumstances, however, herniæ that *are ordinarily reducible become irreducible*, either from some fresh descent of bowel or omentum, or from some extra fulness of intestine from flatus or fæces, &c., and beyond abdominal and local uneasiness, no other symptoms exist, although, if neglected, others will soon appear.

In these cases reduction may be effected by rest in the horizontal posture, a brisk purge or enema, and the administration of small doses of saline purgatives, such as the sulphate of magnesia, so as to keep up a gentle action of the bowels, with the *local application of ice*, the diet being nutritious but not of a bulky nature.

In this way, recently, I procured the reduction of a scrotal hernia, in a boy, æt. 16, after a month's treatment, that had been down three months; and in the case of a gentleman, æt. 36, after three weeks' treatment, in which, both locally and generally, much disturbance existed. This last case I saw with Mr. H. Massey, of Camberwell Green. Old irreducible herniæ are rarely made reducible by treatment, but recent ones can generally be reduced by the means above indicated.

Inflammation of a Hernia.—An inflamed is not a strangulated hernia. Inflammation of a hernia is generally the result of some injury to an irreducible hernia, whether from accident, a badly fitting truss, or ill-advised manipulation; an irreducible hernia after an attack of obstruction may also inflame; and a reducible hernia becoming temporarily irreducible may become permanently so from the same cause, adhesions forming within the sac between it and its contents.

The *local signs* of an inflamed hernia are pain, swelling, and induration of the tumor. In an omental hernia the tumor becomes nodulated and

irregularly hard. In an intestinal, much fluid collects in the sac. When the action is enough to interfere with the natural function of the tube, symptoms of general peritonitis or obstruction will soon appear. These must be dealt with on ordinary principles.

TREATMENT.—*Rest, purgatives* when obstruction in the hernia does not exist, and the *local application of ice* in a bag, are the most important remedies. By such means the symptoms are generally arrested, and when this result does not take place the case passes on to one of obstruction, if not of general peritonitis.

General peritonitis is occasionally met with as a consequence of obstruction, from the adhesion of a piece of intestine to the hernial sac.

I published such a case in 1861, in part iii of my "Clinical Surgery." The notes of it are as follows:

Umbilical hernia; obstruction to the bowels from a sacculated adherent colon; death.—A woman, æt. 56, having had a hernia for many years, was suddenly seized, some twenty-four hours before her admission under the care of Mr. Cock, with symptoms of strangulation. The taxis, under the influence of chloroform, proved successful, but collapse and death followed in twelve hours. After death, general peritonitis was found to have been present; the intestinal coils being all adherent. An umbilical omental hernia, the size of a fist, existed, the omentum forming a distinct sac; to the centre of this the anterior wall of the transverse colon was firmly adherent, forming a kind of pouch. The colon was, however, tolerably free. The intestines above this point were distended, below contracted and empty. The cæcum was of an enormous size, almost filling the lower part of the abdomen; it was here that the tension had been experienced; it was black, and in places the peritoneal coat was fissured, leading one to believe that but little extra distension could have been borne without a rupture taking place. The mucous membrane was also lacerated transversely, and the walls were so thin that they nearly ruptured in handling.

This case is one of remarkable interest. Death had doubtless been caused by the umbilical hernia, but not from its strangulation. Peritonitis was evidently the cause, resulting from a partially ruptured and over-distended cæcum; a condition of bowel apparently having been produced by the traction which had been exerted upon the transverse colon, resulting from the adhesion of its walls to the omental sac.

As elucidating a secondary result of hernia this case must be regarded as a most valuable one; illustrating a point which has not perhaps been sufficiently recognized, namely, the influence of adhesion of the bowel to a hernial sac or the abdominal walls upon the functions of the intestines; for doubtless such adhesions are sufficient to account for many of the griping and painful symptoms which exist in an old and irreducible hernia. The case just quoted must also be regarded as a good illustration of the result of a long-continued interference with the bowel's actions. The over-distension of the cæcum, with its attendant consequences, was apparently entirely due to the interference with its functions, resulting from the union of the walls of the transverse colon to the omental sac. The calibre of the colon itself was not materially diminished, but its power of acting had become paralyzed; the greater the distension of the intestine above, the greater must have been the traction caused by the adhesion, and as a sequel, the greater was the effect of this interference; at last complete paralysis of the part had taken place, and complete obstruction, giving rise to all the symptoms and conditions which had terminated in death.

I imagine it to be quite possible that the smallest traction of a portion of

the calibre of the intestine in a hernia, or otherwise, although accompanied with an open passage of the bowel, is quite sufficient to interfere with the bowel's action, and even at last to cause complete obstruction. Mr. Birkett, in his excellent article in "Holmes's Surg.," vol. iv, 1870, has given a second case with a drawing which I also had the advantage of seeing, and he alludes to the fact that M. Littre called the attention of the profession to the cases illustrated by the above in a paper, "Sur une nouvelle espèce de Hernie, Mem. de l'Acad. Royale des Sciences," 1700, p. 300.

Strangulated Hernia.—A rupture is said to be strangulated when its visceral contents are so constricted as to be irreducible, and the circulation of the fæces and blood of the parts is more or less completely arrested.

This may happen in its first descent, "*recent hernia*," but more commonly it takes place after a hernia has existed for many years, *old hernia*. An analysis of cases that I made in 1856 ("Guy's Reports") indicated that the average duration of an *inguinal* hernia previous to its becoming strangulated was twenty years, and that it was a rare occurrence for an inguinal hernia to become strangulated in its first descent; when this does occur the *hernia* (recent) is generally of the "congenital" kind and not of the "acquired."

The same analysis also proved that the average duration of a *femoral* hernia previous to its strangulation was eleven years, although femoral hernia was far more liable to strangulation, and to strangulation in its first descent, than inguinal.

"Recent" hernia, that is, hernia strangulated on its first descent, both of the inguinal and femoral forms, requires operation far more frequently than the "old" hernia, and is far more fatal.

It was also shown that *umbilical* hernia is far less liable to strangulation than either of the two other forms, that it is little liable to strangulation in its first descent, and that when strangulated it is almost always of very long standing.

The symptoms of strangulated hernia are those of obstruction. In "*old inguinal hernia*" of many years' standing they are usually *chronic*; in "*recent hernia*" and more particularly of the femoral form they are *acute*.

Thus it often happens that in a "recent" hernia, inguinal or femoral, its descent is accompanied by severe abdominal pain in the region of the umbilicus, vomiting and more or less collapse, vomiting first of the contents of the stomach, then of the duodenum, biliary vomiting, and at a later stage of the yellow contents of the small intestine and even fæces. Constipation is usually present, although it is not uncommon for the large intestines to empty themselves on the first onset of the symptoms. With these general symptoms of obstruction the local signs of hernia will be present at one or other of the sites at which a hernia may occur, and the tumor will always under these circumstances be tense and painful, and no impulse will be felt in it on making the patient cough.

These symptoms are common to every form of obstruction whether outside the abdominal cavity from a hernia, or inside from internal strangulation, ileus, or any other cause; but in every case in which they occur the practitioner should carefully examine the site of every possible hernia, and not trust to the patient in any way, for the local signs are often masked by the severity of the general symptoms, and the local cause is overlooked.

The symptoms in an "old hernia" are less acute, but not less characteristic *when vomiting has set in*; but in all probability before this symptom appears the patient will have complained of some general abdominal uneasiness, such as flatulence, a feeling of faintness; nausea, and fulness, with

local pain in the hernia; the nausea will, however, soon be followed by persistent eructations, hiccough, and vomiting; in most of the cases constipation will be present, but in some the desire to go to stool will be great and the straining severe. The local signs of strangulation or obstruction are often so slight as to be disregarded by the patient, and unless the hernia is discovered by the surgeon, his attention will probably not be drawn to it by the sufferer. Thus at Christmas, 1870, I reduced by the taxis a femoral hernia, strangulated for one hundred hours in a man who was unconscious of its presence till a few hours before.

If the obstruction remains unrelieved the powers of the patient will probably become prostrate and collapse more or less complete will show itself with its feeble pulse and cold clammy skin. The vomiting also may diminish in intensity or even cease, at times remaining only as a passive pouring out of the intestinal contents through the mouth without an effort. Pain previously severe may also suddenly disappear. But this condition indicates as serious a collapse of the general power of the patient as it does probably a destruction of the parts strangulated in the hernia. The collapse, indeed, under these circumstances is sometimes so great that the parts about the neck of the sac become relaxed, and the hernia may go up either by itself, or by the gentlest pressure. But such a reduction is too often followed by a fatal collapse, death being under these circumstances usually the result of the shock to the nervous system from the severity or persistence of the symptoms. It may, however, occur from other causes, such as gangrene or death of the strangulated bowel, rupture of the bowel at the line of stricture, fecal extravasation, or peritonitis.

When gangrene of the bowel is the cause of death the collapse may be as great as it is from shock; but it is more lasting and chronic. Death is slower.

When rupture of the bowel and fecal extravasation are followed by collapse, they will have been preceded by symptoms of local or general peritonitis, or by a sudden severe abdominal pain; for in all cases of strangulated hernia in which any delay in reduction has taken place, symptoms of inflammation of the protruded parts, of local peritonitis, around the neck of the sac, and subsequently of general peritonitis, will be sure to show themselves.

Strangulated Omental Hernia is characterized by less severe and acute symptoms. They are the same in nature, but different in degree. The pain is less severe, the vomiting not so marked, constipation is less complete and insuperable; the constitutional symptoms are milder. The local distress is also inconsiderable, the tumor permitting manipulation more freely than when it contains intestine. It will also feel harder and more nodular, more like an obstructed hernia. As time progresses, however, symptoms of local inflammation in the hernial tumor will soon appear with those of local peritonitis, and when these appear they will be as severe as in any other form of strangulated hernia, and as destructive.

A strangulated omental hernia, consequently, requires as active surgical treatment as any other, for it leads to the same end—a fatal peritonitis.

Pathological Changes, the Result of Strangulation.—Accepting the definition of a strangulated hernia that has been given, the first effect of the *partial* arrest of the circulation through the parts is congestion, this congestion being accompanied by its usual consort, *serous effusion*. When *complete* arrest has taken place the congestion will be more thorough, and the surface of the bowel will appear of a red-purple or blackish hue (Fig. 173), the tissues themselves being thickened from effusion into their meshes,

or blackened by extravasated blood, wholly or in spots (Fig. 174). When they have been much manipulated by the "taxis," the extravasation of blood into the tissues may be very marked. At this stage of the affection,

FIG. 173.

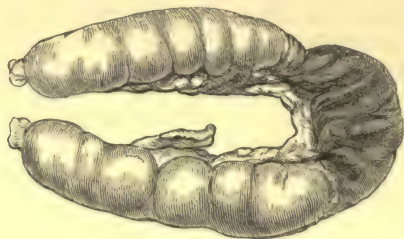
Drawing 481^o. (Birkett.)

FIG. 174.

Drawing 481^o. (Birkett.)

the degree of this congestion will depend upon the intensity of the strangulation, and beyond a thickening of the tissues no other local change may take place.

When, however, the strangulation has been lasting, and an inflammatory action has been added to that of congestion, the bowel will be found not only swollen but soft, the natural glistening aspect and elasticity of its coats will have become changed for a dull appearance and leathery condition. The serous surface may indeed be covered with a layer or with floculi of lymph, or the knuckle of intestine, wholly or in part, may be soft and gangrenous, ash-colored spots, or even perforations, being visible on its surface.

At the neck of the sac other changes will be found, which will materially depend upon the character and seat of the constricting force. When the line of strangulation is rigid and linear, as in femoral hernia, the whole knuckle of bowel strangulated may be rapidly destroyed by gangrene, either as a whole or in part.

When the pressure is more diffused and less rapid, as in inguinal hernia, ulceration of the mucous membrane at the line of stricture, even to perforation, is more common, the grooved or sulcated condition of the serous surface in the line of stricture being found in both.

Within the abdomen every indication of peritonitis from the mere greasy condition of peritoneum to fibrinous or even suppurative effusion, may be met with. In most cases local peritonitis will be found about the seat of hernia, the strangulated portion almost always resting at the neck of the sac, if not adherent to it, with more or less matting together of the neighboring coils. In some the peritonitis will be general.

That this peritonitis is to be directly attributed to the strangulation of

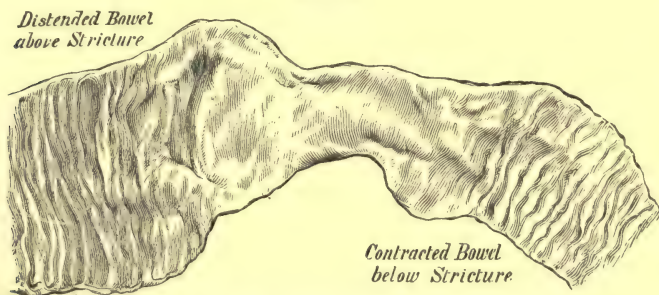
the intestine is generally acknowledged, few cases of strangulated hernia remaining long unrelieved without local or general peritonitis making its appearance. It is also not to be disputed that this peritonitis is often aggravated, and at times caused by the reduction of the inflamed and injured contents of the hernial sac into the abdominal cavity; but to say with Mr. Hutchinson and M. Girard that it is the return of the intestine into the abdomen that *usually* gives rise to the peritonitis, is an assumption which the facts as hitherto known do not bear out.

When the intestine has sloughed wholly or in part, and discharged itself through the wound, an artificial anus is said to exist; and this result is far more common after femoral than inguinal hernia.

When the bowel subsequently ulcerates after its reduction, either at the line of stricture, as in inguinal hernia, or at the centre of the knuckle, as in femoral hernia, extravasation of feces may take place, half of these cases of extravasation being either general into the peritoneal cavity, and fatal, or local about the neck of the sac.

The following facts, taken from a paper of my own ("Guy's Hospital Reports," 1856), on the causes of death in hernia, will tend to prove these points. Out of 17 cases of artificial anus after hernia, 13 were femoral, 3 inguinal, and 1 umbilical. Out of 15 cases of gangrenous bowel, 11 were femoral, 4 inguinal. Thus, out of 32 cases of gangrenous bowel, 24 were femoral, 7 inguinal, and 1 umbilical, clearly proving that *gangrene of the*

FIG. 175.



Stricture of the small intestine after strangulated hernia.

intestine and artificial anus are more common after femoral than inguinal hernia.

Out of 15 cases in which the strangulated bowel was found perforated, 10 were femoral and 5 inguinal; in 4 the perforation was at the line of stricture, all being inguinal; in 11 the perforation was in the centre of the knuckle, 10 of these being femoral. In 8 of these 15 cases, extravasation of feces was prevented by inflammatory exudation sealing the aperture. In 7 it existed, but in 5 only of these was it general; in the other 2 it was local. Of these 7 cases, in 2 the taxis was the direct cause, in 1 gangrene, both being cases of femoral hernia; in 4 ulceration at the line of stricture was the cause, all being inguinal.

From these facts it is evident "that ulceration in the line of stricture with fecal extravasation is more frequent in inguinal than in femoral hernia, and that when it is found in the latter, it is generally from rupture of the bowel from forcible taxis."

As a result of a strangulated hernia, I must mention a stricture of the intestine due to a subsequent contraction of bowel that has been strangu-

lated. An example of this took place in 1870 in my practice. A woman, æt. 52, upon whom I operated for strangulated femoral hernia, of thirty hours' duration, without opening the sac, did well after the operation till the seventh week, when vomiting appeared, and death took place in the eleventh week, from intestinal obstruction, and after death a most complete stricture of a knuckle of bowel was found (Fig. 175).

The fluid found in the hernial sac varies according to the condition of its contents. In the early period of strangulation, when arrest only to the contents of the hernia with its vessels, is present, simple serum will be found. When a more extreme congestion exists the serum will be more bloodstained. In still worse examples, where extravasated blood has taken place into the tissues, the fluid will contain blood elements or blood itself. When the hernial contents are inflamed, flakes or flocculi of lymph will be floating in the dark fluid. When the bowel is gangrenous, fetor will be observed. When perforation has taken place, feces will be mixed with the fluid, and often gas. When the hernial tumor is red, infiltrated, and emphysematous, the surgeon may safely infer that sphacelus of the gut exists.

Thus, the condition of the fluid and the external aspect of the sac are valuable aids to diagnosis and prognosis in strangulated hernia.

Treatment of Strangulated Hernia.—When a hernia is strangulated, nothing but its immediate reduction is to be entertained. Delay is most deleterious. In the surgeon it is criminal, for every hour of strangulation adds to the danger which it is his duty to diminish. This is to be done by manipulation, or by what is technically called "the taxis," and should this fail, by "the operation" of herniotomy.

To aid the surgeon in the adoption of these means, the use of chloroform, or any of its allies, cannot be too highly praised, for it contains within itself all the advantages of every other form of treatment that has ever been employed, without a single disadvantage. It renders the reduction of a hernia by the taxis, a gentle, and comparatively, a simple, measure, and certainly a far more successful one than of old. It facilitates, also, the operation of herniotomy on the failure of the taxis. Indeed, the value of chloroform in strangulated hernia is so great that I would urge where it can be rendered available, the taxis should never be employed without it, and that on the reduction of the hernia failing to be accomplished, "the operation" ought to be performed. The warm bath, the administration of opium, the injection of tobacco, the local application of ice, for strangulated hernia, are, in comparison, poor and unreliable remedies. They have had their day. To use them now, when we have at hand a far more valuable drug at our disposal, is trifling with life. In *obstructed* hernia, and under certain circumstances, they are still of use, but in *strangulated* intestinal hernia, recent or old, inguinal, femoral, or umbilical, chloroform, the taxis, and operation, are the three great means of securing reduction upon which the surgeon ought consecutively to rely. The taxis is not, however, equally successful in every form of strangulated hernia. In *inguinal* cases two-thirds, at least, are reduced by the taxis, a large proportion of these being successfully treated with the patient under the influence of chloroform, when failure by the taxis has taken place before. Strangulated old herniæ are more successfully treated by the taxis than recent ones, which are rarely amenable to such treatment.

In *femoral* hernia, on the contrary, the taxis is not half so successful as it is in inguinal, and it is far more fatal. It is most successful in "recent" cases; in old cases it rarely succeeds.

In *umbilical* hernia two-thirds of the cases are reducible by the taxis.

The Taxis.—With the patient under the influence of chloroform, and so

placed on the back, with the shoulders raised and the legs partially flexed and rotated inwards, in order to relax all the parts that can possibly affect the neck of the sac, the surgeon should steadily grasp with the fingers and thumb of one hand the neck of the sac, in order to fix it, and at the same time prevent the contents of the sac—from being pressed—from bulging round the orifice. With the other hand the tumor, if large, is to be raised and gently compressed so as to empty it of its serous, gaseous, fecal, or venous contents, and thus lessen its size. Having effected this a little continued pressure will probably be followed by the sudden rush backwards into the abdominal cavity of the hernial contents.

When this rush occurs the surgeon may be certain that all is well; when the tumor has diminished in size, and its diminution has not been accompanied by the well-known sensation, a feeling of doubt should always remain in the mind as to the result, for the want of this symptom of healthy reduction, should suggest the possibility of a rupture of the bowel, or of a reduction into one or other of the unnatural pouches, which are now known to exist under certain circumstances at the neck of an inguinal hernia. To facilitate reduction a *gentle* kneading movement of the fingers at the neck of the sac may be made in inguinal hernia, as well as a steady traction downwards of the tumor, this traction rendering the neck of the sac a straighter channel for the hernial contents to pass through; for the same end the sac itself may at times be pinched up with the fingers of one hand and drawn downwards. Violence in manipulation under all circumstances is unjustifiable, and in proportion to the period of strangulation as indicated by the vomiting, is the danger increased. In femoral hernia also it is comparatively far more injurious than in inguinal, for not only may a bowel be ruptured by forcible taxis, an accident more common in femoral than inguinal hernia ("Guy's Rep.," 1856), but it may be so bruised as to be irreparably destroyed. A preparation and drawing (Fig. 174) in the Guy's Museum show such extravasation of blood into the strangulated bowel of a femoral hernia as to cause its complete death, this extravasation having been clearly due to forcible taxis.

Where evidence exists that gangrene of the contents of the sac has taken place, or where, indeed, there is a suspicion of such a result, the taxis should not be used. In femoral hernia, recent or old, where fecal vomiting has existed for some hours, the taxis is a dangerous practice, and in all old cases it is so unsuccessful that reduction by herniotomy is a more certain and a safer method. If there be hiccough, says Birkett, the taxis is inadmissible. The taxis may succeed without chloroform, but as a rule with the patient under chloroform a hernia that is capable of being reduced by taxis goes up on the gentlest manipulation, and when this result does not take place force will not only not succeed, but must prove injurious.

When the taxis succeeds vomiting usually disappears, although it may be kept up to a slight extent as an effect of the chloroform. The abdominal dragging pain will, however, at once be relieved. After the reduction of the hernia a pad should be carefully adjusted over the neck of the sac as a matter of precaution, and when the patient has a cough the necessity of doing so is increased, for I have known the hernia descend, and a renewal of all the symptoms take place from a want of this care under these circumstances; indeed it is a wise measure to do so till a truss has been obtained. The patient under all circumstances should be kept at rest for a few days after the reduction of a strangulated hernia. The diet should be nutritious but not solid, till the bowels have spontaneously acted, no aperient being administered under any but exceptional circumstances, for the bowels will to a certainty act as soon as the effects of the injury they have sustained by

strangulation have passed away, and they have recovered their natural tone. Should abdominal symptoms appear which can be attributed to a want of the natural action of the bowel an enema may be given, and repeated when required with advantage. Stimulants are to be cautiously given. When the bowels have acted naturally the patient may be pronounced convalescent, and the ordinary diet, &c., may be allowed.

Where chloroform is not at hand, and cannot readily be obtained, a good dose of opium, such as a grain and a half of the solid or thirty drops of the tincture for an adult may be given and repeated, for when a patient with an old hernia is brought fully under the influence of this drug reduction may often be obtained by manipulation. In the very earliest hours of strangulation, before vomiting has become severe or passed beyond stomach vomiting, this practice is also at times successful, and it may be tried when the surgeon cannot obtain the patient's consent to perform herniotomy, should reduction not be effected by the taxis under chloroform, or when time has necessarily to be lost in making arrangements for operative relief. Under the same circumstances a *hot bath* (99° F.) may be used. The local application of ice may be employed in *old* cases of hernia where the symptoms are chronic; and delay is a necessity or expedient; in omental hernia it is particularly valuable. It should be applied over the whole tumor in a loose bag. A purgative is never admissible with a strangulated hernia.

The taxis with inversion of the body, with the legs flexed, pelvis raised, and shoulders depressed, has been successful in causing the reduction of a hernia. On a bed, it may be done by pillows placed below the pelvis. If one of Alderman's chairs or a lithotomy couch is at hand, it may be used.

Some surgeons have, with a folded sheet placed round the abdomen, over the umbilicus, and the patient in the recumbent position, forcibly drawn the contents of the abdomen upwards.

Both these methods are founded on the principle of withdrawing by position and force the contents of the sac into the abdominal cavity.

They are possibly justifiable when herniotomy is not sanctioned, chloroform cannot be employed, and delay is dangerous. They cannot be strongly recommended.

The taxis should never be employed for any lengthened period. With the patient under chloroform a femoral hernia of average size, that of a walnut, should never be manipulated for more than two minutes; half that time, or less, is usually sufficient to effect reduction where it is to be secured; any more prolonged effort will be injurious, it should never be forcible. In large femoral herniæ, inguinal, or umbilical, five minutes may possibly be allowed; but the quarter and half hour's manipulation, that is too frequently talked about, is dangerous in the extreme. In very large herniæ ten minutes may be allowed without chloroform, and periods half as long again may possibly be called for. It is from this fact, coupled with another, that without chloroform twice the force is needed, that the use of the anæsthetic is to be recommended.

The reduction of a hernia by *gentle* taxis with a patient under chloroform is a simple, rapid, and successful operation. The reduction of a hernia by *forcible* or prolonged taxis without chloroform is a dangerous and far less successful proceeding. In femoral hernia, indeed, herniotomy had far better be employed. Under chloroform the taxis is almost always successful in inguinal hernia.

When the taxis has failed, nothing but an immediate operation is justifiable. The operation is not of itself dangerous, although the condition that demands it is exceedingly so. It is not, and should not be, regarded as a last resource; in many cases it should be the first resource. When a

patient is hanging, the first thing any one does is to cut the rope that is causing strangulation; no other means are admissible. When a piece of bowel is strangulated, the strangulating medium requires division to give it freedom; the doing of this adds nothing to the danger of the case. The danger lies in the strangulation, and this increases every minute.

Herniotomy or Kelotomy remains now to be described, and let it be repeated, *that it is to be performed directly the reduction of a strangulated hernia by the taxis has failed, and, if chloroform has been used, whilst the patient remains under its influence.* To submit a patient to the depressing effects of chloroform to apply the taxis, and on its failing, to allow any period of time to pass before resorting to herniotomy is a practice to be condemned, a second administration of chloroform for the operation having no beneficial influence; it would be better for the patient and far better practice to delay the application of the taxis till chloroform can be obtained and the arrangements for operation made, on the taxis failing.

The Objects of the Operation are to liberate the strangulated hernial contents, and, in a general way, to return them into the abdominal cavity, exceptional cases occurring in which it is better practice to leave them in the sac, wholly or in part; and others, in which it is impossible to reduce them; but to these points attention will be drawn further on.

To Liberate the Strangulated Hernial Contents, the cause of the strangulation must be divided; and this, as previously shown, may be found in the tissues outside the sac, in the neck of the sac itself, or in the contents of the sac.

When they are found outside the sac, as they usually are in femoral hernia, the opening of the sac is rarely needed, their division outside being all that is required.

When the neck of the sac is the seat of obstruction and prevents reduction, an opening into it sufficient to allow of its division is all that is necessary. When the difficulty lies in the contents of the sac, the surgeon will be required to lay the whole open, and to expose it in order to remove it. But it is to be remembered, that the less the contents of a hernia are exposed and consequently manipulated, the better are the results; that when all that is desired can be secured by the division of the tissues outside the sac, there is no need of doing more; that when the division of the neck of the sac allows of the reduction of the hernia, a greater exposure of the contents of the sac is unnecessary and wrong, for in hernia as in all surgical interference, the surgeon should carry out his objects in the simplest way his art will allow; he should never allow himself to do more than the absolute necessities of the case demand. Meddlesome surgery is always bad, but in hernia it is too often fatal.

These remarks are, however, only entirely applicable to cases of strangulated hernia, in which the whole contents of the sac are reducible; for where *some portion remains behind*, a feeling of doubt may at times remain in the surgeon's mind as to the thoroughness of the reduction of the strangulated portion, or the condition of what is left, and, under these circumstances, it is usually advisable that the sac should be opened and explored; but it is better to do so after the partial reduction of the hernia, when, in all probability, the strangulated bowel has been reduced, and is consequently out of harm's way, than with the whole contents of the sac *in situ*, when they may be exposed. When the *hernia cannot be reduced without opening the sac*, the whole must necessarily be explored. It will be thus seen that the question of opening or not opening the sac resolves itself into the necessities of the individual case. Where reduction can be effected

without it, the "minor" operation is sufficient; where reduction cannot be effected by the "minor" the "major" operation must be performed.

The surgeon who opens the sac in *every* case, clearly often does so unnecessarily. The surgeon who opens it only when reduction cannot be effected without so doing, or when any uncertainty exists as to the condition of the parts remaining in the sac, is free from such an error, "and although we dare not venture to say that some of the fatal cases which have occurred after opening the sac might have terminated differently had it not been incised, we do not hesitate to affirm, that the untoward circumstances stated as likely to happen when the sac is not opened, have not occurred" (Birkett), and both by my analysis of 126 fatal cases of hernia ("Guy's Rep.," 1856) and by my experience since that date this view is confirmed. I fairly showed that in no single fatal case could the opening of the sac have had the slightest influence in retarding or preventing the fatal result. The surgeon who advocates the major operation in all cases still practices the taxis, and I take it is always well pleased to effect the reduction of a hernia by such means. The operation of herniotomy "external to the hernial sac" differs only from the taxis in the skin wound, and in what way the necessity for that wound renders the taxis an unsafe measure it is difficult to conceive.

It would be as reasonable to reject the administration of chloroform for the renewed application of the taxis in cases where the taxis had failed to reduce the hernia without its aid, as to say that the necessity of a cutting operation because the taxis had failed requires ocular inspection, and manipulation of the strangulated and therefore already injured bowel.

To argue that the liberation of a strangulated bowel is not complete until it has been carefully examined, and that without opening the sac a hernia, strangulated by omental or other adhesions, or by the neck of the sac, may be reduced, are objections, which if applicable at all are as applicable against the taxis as any operation; they are indeed of little weight. The operation of herniotomy without opening the sac has been ably advocated by Petit who first adopted it in 1718, Munro, in 1770, Key, in 1833, Luke and others.

So far as statistics go, or are of value towards the solution of this point, they are in favor of not opening the sac. Thus out of 59 cases of strangulated femoral hernia operated upon at Guy's Hospital in eight years, in which the sac was *opened*, the mortality was 50 per cent., and out of 45 cases in which the sac was *not opened* it was only 30 per cent. The difference between the two classes of cases being 20 per cent. in favor of the minor operation.

Out of 35 cases of inguinal hernia in which the sac was *opened*, 60 per cent. died, and out of 9 in which the sac was not opened, 2 or only 22 per cent. died; the difference between the two classes in inguinal hernia being 40 per cent. in favor of *not opening*. But it must be remembered that as a rule the cases in which the sac was not opened, were of a more favorable kind than those in which it was opened.

In umbilical hernia, however, it is a rare thing to save a patient after opening the sac, and exposing its contents; when this is not done a good result may be looked for.

Whenever the taxis is applicable to a strangulated hernia and fails, herniotomy without opening the sac is applicable, and where reduction is effected nothing more is needed. Where reduction cannot be effected or some doubtful piece of something remains in the sac, or the contents of the sac have not gone back with their normal rush, or the symptoms persist, or any doubt about

the condition of the parts at the neck of the sac is raised, an exploration of the sac and its neck is absolutely necessary.

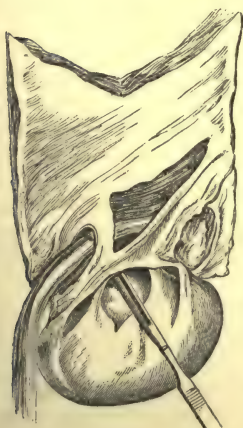
Wherever the *taxis* is *inapplicable*, that is, when the strangulation has been of so long a duration, the symptoms so severe, fecal vomiting so persistent, and local as well as general symptoms indicate the probability that the strangulated gut has died or is dying, and whenever during the application of the *taxis* by the sudden collapse or yield of the tumor without its reduction, the fear is excited of some rupture of the bowel having taken place, herniotomy by the minor operation is inapplicable, the sac must be laid open and its contents dealt with.

The Operation itself.—The patient having been brought under the influence of chloroform, and placed with the shoulders slightly raised and the knees flexed upon a pillow, the integument over the seat of hernia should be shaved of all hair; an incision is then to be made over the neck of the sac; that is, in inguinal hernia, along the line of the inguinal canal, from the internal to below the external ring; in femoral, over or on the inner side of the crural ring, either in a vertical or oblique direction, in the course of Poupart's ligament, the former being the better. In this incision all the soft parts should be divided consecutively down to the sac, each layer of tissue being divided the full extent of the wound, while all vessels as they bleed should be twisted.

When the sac has been exposed, the seat of stricture outside its neck is to be felt for with the index finger, and when felt a director may be carefully passed beneath it, Aston Key's director, shown in Fig. 176, being by far the best.

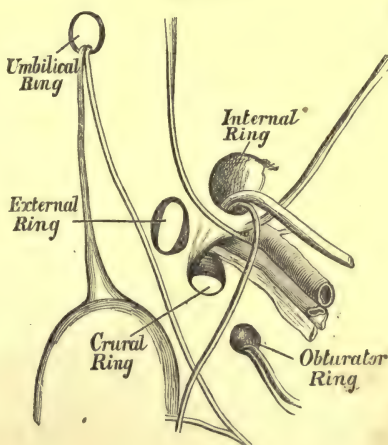
With a hernia knife, such as that figured (Fig. 178), straight or curved, or herniotome (Fig. 179), the stricture is then to be divided, the incision *upwards* being the safest, to avoid the epigastric artery (Fig. 177). This

FIG. 176.



Key's director passed beneath the seat of stricture of a strangulated femoral hernia outside the sac, beneath the fascia propria. Taken from his work on "Hernia."

FIG. 177.



Drawing to illustrate the relative position of all the abdominal rings from within.

division must not be too free—a quarter of an inch is generally ample in small herniæ—but it should only be just enough to allow of the return of the hernia without force. It is better to have to increase it than make it

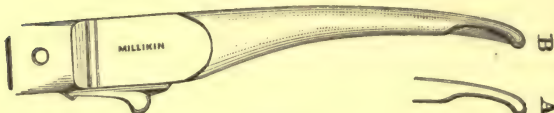
too large at first. The stricture having been divided outside the sac, reduction by the gentlest manipulation is to be attempted, and when the contents of the sac go up with a rush all the surgeon needs has been effected. When no indications of reduction show themselves, or a portion of the contents of the sac have disappeared, but not with the characteristic jerk, or some piece

FIG. 178.



Hernia knife.

FIG. 179.



Herniotome director—A, Blade withdrawn; B, Blade exposed.

has been left behind, the sac must be opened. To do this care is needed, the danger of carelessness consisting in wounding the bowel. To avoid this, the sac may be nipped between the thumb and finger, or seized with a pair of forceps, and slightly raised, a small opening being made into the raised portion with a scalpel applied laterally. Through this opening a director is to be passed, with its point kept close to the walls of the sac, upwards towards the neck of the sac, and downwards towards the fundus, the sac being divided upon it with a bistoury. The escape of fluid usually indicates to the surgeon the opening of the sac, and the character of the fluid the condition of its contents. But fluid does not always run away when the sac is opened, and at other times the escape of fluid from a cyst on the hernial tumor may mislead. The sac having been opened, its contents are to be examined, and in doing this the utmost gentleness must be employed. When a *knuckle of intestine is adherent*, and is neither gangrenous nor perforated, the abdominal cavity is its best place. It may be black from congestion and spotted from ecchymosis; it may be granular from lymph, or even covered with false membrane; but as long as it possesses its living resiliency, is not fetid, flaccid, like wet wash-leather, ruptured, or perforated, it should be returned. When a *large quantity of injured intestine* is found in the sac, it had better be left, the surgeon simply relieving the constriction by the division of the cause of stricture. The neck of the sac is to be divided with the utmost care. The director, when employed, should be kept close to the walls of the sac, and guided by it towards its mouth. Its point should be carefully kept away from the bowel, and not introduced further into the abdominal cavity than to insure the safe division of the stricture, and when the knife is passed along its groove the finger of the operator should carefully press the strangulated bowel away from it to protect it from injury.

When the director is not used the finger should be introduced to the neck of the sac, and the knife upon it, with its side pressed into the pulp of the soft parts. Both having reached the neck, the knife may be carefully turned upwards and the tissues divided, the point of the finger measuring the extent of the incision. When a knife, such as that figured (Fig. 179), is used, no director need be employed.

When the *intestines are adherent* to the sac, or to one another, by filamentous or soft adhesions, these may be divided, but such are only met with in recent herniæ.

The fibrous adhesions of old herniæ had better be left alone, and the hernia looked upon as irreducible, the surgeon being content, under these circumstances, with dividing the stricture, and thus relieving the strangulation, but not attempting its reduction. Should a fresh piece of bowel have come down this should be reduced, but the old hernia is to be left.

The strangulated intestine should be handled with extreme delicacy. *Any drawing down of its neck* to examine its condition is to be avoided. Such an act can do no good, but often does much harm, by tearing away adhesions that would have sealed an ulcerated orifice, prevented extravasation, and assisted repair. *Any introduction of the finger* into the abdominal cavity is also to be condemned, save under any exceptional condition. With the careful return of the bowel to the neck of the sac, surgical interference ought to cease. The surgeon may satisfy himself that such an end has been attained without probing the abdominal cavity with his finger, and thus risking life by tearing away adhesions, and undoing in a moment what nature by her own processes had probably been doing from the first period of strangulation, to shut out from the general abdominal cavity what might prove injurious and dangerous to life.

When the *bowel is dead*, as indicated by its flaccidity and ashy color, all thought of its reduction must be put aside. The soft parts covering in the sac, with the sac itself, should be freely laid open, so as to expose the whole sloughing mass, and the *intestine left to nature*, to pass into what is called an "artificial anus." The neck of the sac may, however, be carefully divided, not, however, with the view of relieving the strangulation, for when the gut has become gangrenous, no strangulation exists to be relieved, but with a view of allowing the intestinal contents to pass outwards when an external opening takes place, and, should life be spared, for the subsequent retraction of the bowel towards the abdominal cavity, to effect a natural cure.

No free incision into the gangrenous bowel, no stitching of the intestine to the margin of the wound, is wanted, for fæces will soon find their own way through the opening that has been made by the artificial anus, and the surgeon may be sure that within the abdomen sufficient repair has gone on to fix the intestine that had been strangulated to the neck of the sac, and thus prevent its immediate retraction; for it must be remembered, that as time goes on, this retracting process is the very one that nature adopts to procure a spontaneous cure of an artificial anus.

When the *bowel is perforated by ulceration or ruptured*, and the opening is not a large one, the neck of the sac is to be incised as in an ordinary case, and the intestine that appears reparable replaced, the perforated or ruptured portion being left at the mouth of the sac. When the rupture or perforation is small, there is no objection to the surgeon placing a ligature round the wound, and replacing the gut in the orifice of the sac, for plastic lymph will probably be poured out within a few hours, and the parts sealed from the abdominal cavity.

When the *bowel is in a doubtful condition*, and the surgeon is not sure whether he can say it is irreparably dead, or going to die, the abdominal cavity is still its best place, when it can be returned. Aston Key advocated this plan years ago, and modern experience has not disproved its value. "The danger of abdominal extravasation will not be increased by replacing the injured bowel at the neck of the sac; for, should sloughing of its coats

ensue, the slough may be walled in by adhesion of the surrounding peritoneum, and fecal extravasation be prevented" (Key, "Guy's Rep.," 1842).

In 1856, in an inquiry into the causes of death in hernia, founded on an analysis of 156 fatal cases, the same conclusion came forcibly before me. The weight of evidence led me, then, to express the opinion that there is only one condition of intestine in which its reduction to the neck of the sac is not advantageous, and that is when it is decidedly ruptured by gangrene or ulceration, my own materials tending to support the opinion of Mr. Aston Key, as stated to the writer, in 1849, "that in all conditions of the intestines the abdomen was their right place."

Mr. Hutchinson, who believes peritonitis to be the direct result of the reduction of an injured bowel into the abdominal cavity, advises in all cases that the damaged gut, if found in a bad condition, should be left in the sac; and Dr. Girard goes further, he advises the contents of the hernia, under all circumstances, to be left, the surgeon contenting himself by freely dividing the stricture. I by no means agree with this practice, nor with the principle on which it is based.

When the return cannot be pursued on account of adhesions, the neck of the sac should be incised, and the case left to nature. In large, umbilical herniæ this practice is a valuable one.

When omentum is found in the sac with intestine, and has only recently descended, it may be returned. When it has been down for some time, is irreducible, and is only a small piece, it may be left alone, the omentum, doubtless, often acting as a plug to the orifice of the sac; when it is diseased, or in large quantities, it should be ligatured in two or more portions and cut off, the ligatures being applied as near to the neck of the sack as possible, care being observed not to disturb the parts at the neck.

Simply to cut off the omentum and tie or twist the vessels is risky, the omentum always being highly vascular, and small vessels are apt to bleed much; indeed, cases are on record in which a fatal hemorrhage took place after this practice. When diseased omentum is left in the sac, prolonged suppuration often follows. I have never known any bad result follow the practice inculcated above. Whenever intestine and omentum are found together in a hernia, much care is called for. The intestine is generally to

be looked for behind the omentum, but it is often wrapped up in it, and, in not a few cases, it is covered by an omental sac. Under all these circumstances, the intestine is to be exposed and carefully reduced, care being taken that no adhesions at the neck of the sac, no bands, bind the bowel down to the omentum and keep up the strangulation. An omental sac is on no account to be returned into the abdomen unopened. Omental sacs are generally found in femoral hernia. An interesting paper by Mr. Prescott Hewett ("Med.-Chir. Trans.," 1844) may be referred to on this subject.

AFTER-TREATMENT.—When a hernia has been returned into the abdominal cavity, the more the case is left to nature the better. As a matter of precaution after operation, as after its reduction by the taxis, when the wound has

been brought together with strapping or suture, a pad may be adjusted over the part with a spica bandage (Fig. 180).

A suppository of half a grain of morphia or more should be at once in-

FIG. 180.



troduced into the rectum, and repeated in an hour, or, should pain render it necessary, a little ice may be allowed for the patient to suck, when thirst is great; but the less that is taken by the mouth the better. When the powers are very feeble, brandy, soda-water, and ice, may be given in small quantities.

Should no chloroform sickness complicate the case after the first twelve hours, beef tea, arrowroot or milk, may be given, a pint, or a pint and a half in the twenty-four hours being ample. Stimulants are to be allowed as the powers of the patient indicate, but always with caution.

On the second day the wound should be dressed, water-dressing being all that is usually required, and the lower end of the wound being left open for the escape of discharge. Should pain continue, and symptoms of peritonitis appear, the opium or morphia suppositories may be repeated twice a day or more frequently; indeed, the patient should be kept under the gentle influence of opium till the symptoms are relieved; hot fomentations should be applied to the abdomen. Purgatives are never to be given if the bowel has been bruised or otherwise injured by its strangulation, and as soon as it has recovered its tone, its natural action will return; any goading of it to action by medicine will do harm. "A bruised bowel," says Aston Key ("Guy's Rep.," 1842), "is placed by nature in a state of rest; the exhaustion of the nervous energy of the part diminishes in the muscular tissue the disposition to contract. *Such inactivity of the bowel should be encouraged and not thwarted* by irritating purgatives. The surgeon's anxiety to procure stools should yield to the evident necessity for time being allowed for the restoration of the natural powers of the injured bowel."

Three, five, ten, or even twenty days may be allowed to pass without any action of the bowels, without anxiety or without purgatives, as long as no other indications of mischief show themselves, but during this time liquid food alone is to be given with stimulants as needed. When some local distress is present, which the surgeon can fairly attribute to the constipation, an enema of gruel and olive oil may be administered, and this may be repeated, if necessary, such a simple intestinal stimulant being usually sufficient to induce the bowel to act should it have recovered its tone. When the bowels have acted naturally, convalescence may be declared and the usual diet allowed.

Any violent action of the bowels soon after the operation is to be watched with anxiety; in old people it is too often followed by a fatal collapse. Should it be too profuse it must be checked by opium. The patient should on no account be allowed to get up and walk until he has been fitted with a good truss.

Complications of Hernia.—*Double Hernia.*—When *two or more herniæ* exist with symptoms of strangulation, the one that on careful examination appears to be the most tender is to be first explored, and should this operation not give relief, the second must be treated in a like manner; indeed, should no relief be given by the second operation, and a third hernia exist, it should be explored, for it cannot be too often repeated that the operation is not one of danger, when compared with the necessity of the case that demands it. Dupuytren, in his "Leçons Orales" has recorded such a case. In the third part of my "Clinical Surgery," p. 204, I have likewise recorded another in which Mr. Cock was the operator; the patient was a man æt. 70, the left side was explored first, but as the symptoms continued the right was operated upon twelve hours later. Both herniæ were old inguinal, in both the sac was opened, and recovery took place.

Displaced Herniæ.—No cases demand closer attention than these; when understood and appreciated they may be successfully treated, when misun-

derstood they are sure to be overlooked. Thus it may be accepted as a fact that a strangulated hernia with its sac may be bodily reduced within the abdominal ring and behind the abdominal parietes, the intestine being still held by the neck of the sac. This form was first described by the French writers as "reduction en bloc," or "en masse," and by Mr. Luke in this country ("Med.-Chir. Trans.," 1843).

In November, 1871, I had this fact demonstrated to me in a case I was called to see by Mr. Berry of Pentonville. It was in a lady, æt. 64, who was said to have been ruptured for years, and had worn a truss. When I saw her she had been vomiting for a week, and a tense femoral hernia existed. Under chloroform I cut down upon the sac and divided the neck of the crural ring, and on attempting reduction of the sac's contents by gentle manipulation, to my surprise the sac with its contents suddenly "popped" into the abdomen. By a little abdominal pressure it was made to reappear, and it did so in the same sudden way, a second attempt at the taxis was followed by the same result, and renewed pressure upon the abdomen with a like reappearance. For the sake of fully satisfying myself and my medical friends of the nature of the case, I reduced the hernia *en masse* a third time, and then found some little difficulty in securing its reappearance. When I did so I took hold of the sac with my forceps, carefully opened it, and exposed the bowel without letting the sac go; I then divided its neck by a herniotome and reduced the bowel, keeping the sac well down. On the second day the bowels acted, but the patient subsequently died of a low form of peritonitis. In this case the whole process of reduction *en masse* was demonstrated most clearly before me, and it made me ask myself the question whether the same result might not have taken place had I attempted its reduction without operation by forcible taxis; for the facility with which the sac passed up within the crural ring was somewhat startling.

My friend Mr. Henry Morris showed a specimen illustrating this fact at the Pathological Society. *Vide* "Trans." for 1871. Such cases are, however, very rare; when they do occur, they are probably in femoral hernia. Diagram, Fig. 169, page 302, illustrates these cases.

The majority of cases reputed to be of this nature are probably caused by other lesions of the sac, and the credit of having made this out is due to Mr. Birkett, who in an able paper read before the Med.-Chir. Society, in 1859, gave the following explanation. The observations however only apply to *inguinal* hernia.

In the *first* form the neck of the sac becomes detached by force from the internal abdominal ring, and pushed upwards beneath the abdominal walls, the intestine within the sac being strangulated by the orifice of the sac (Fig. 166).

In the *second* form (Fig. 167) "as the effect of forcible and long-sustained compression of the hernial tumor, the delicate serous membrane of the sac is rent, burst, or torn, and the hernia makes its escape through the aperture into the subserous connective tissue; its course outside the peritoneal sac is advanced by continued pressure; and detaching the connections of the neighboring peritoneum, it forms for itself a pouch between that serous membrane and the internal abdominal fascia."—BIRKETT. The posterior part of the neck of an inguinal hernial sac is the usual seat of the rupture, and the position of the artificial sac is downwards and outwards. The "congenital" form of hernial sac is also the more prone to the accident.

The indications of the accident having taken place are as follows: I give them in Birkett's words—"The tumor becomes flaccid, and, therefore, smaller; the bulk of the tumor slowly diminishes as the pressure is continued, until at last very little, if anything, can be felt, but the surgeon has

failed to experience that sudden jerk so characteristic of the escape of the hernia from the gripe of the mouth of the sac, as it enters the abdominal cavity. After the effects of the chloroform have passed away, all the symptoms of strangulated bowel recur, and, perhaps, with increased force. Even the tumor itself may reappear and recede on the application of slight pressure."

When this condition is found there is but one form of practice to follow, and that is the exploration of the sac; at its neck, two orifices will be found, one dipping down into the artificial sac, and the second into the abdominal cavity; from the latter the bowel will be seen to pass through the former into the artificial sac. The surgeon must then draw out the bowel from the sac through its false orifice, and having freely divided the true neck or abdominal orifice of the sac, replace the intestine, and "the exercise of great care and caution is needed to prevent the entrance of the hernia once more into the abnormal space outside the peritoneal cavity."—BIRKETT.

A Third Form.—An intermuscular, interstitial, or *intra-parietal* sac, has also been described, being a kind of diverticulum from the inguinal sac; it is almost always found, according to Birkett, associated with the congenital form of hernia, and this sac may be found in the anterior abdominal walls, in an upward, outward, or inward, direction, mostly behind the abdominal muscles in front of the abdominal fascia; in some instances in front of the external oblique muscle beneath the skin. Birkett refers to a case recorded by Scarpa, and a second by Dr. Fano.

In a second class of cases, the sac extends into the iliac fossa and rests upon the iliacus muscle, between the internal abdominal fascia and peritoneum; or, directing itself inwards, it passes behind the horizontal ramus of the pubes, and reaches the side and front of the urinary bladder (Birkett). Fig. 168 illustrates this form of hernia.

At Guy's Hospital, a preparation taken from a patient of my own confirms it. The disappearance of the tumor without the characteristic jerk and the persistence of the symptoms indicates all these three forms. The treatment in all is the same as that described in the second form.

Prognosis.—As the danger of a strangulated hernia depends upon the amount of damage the intestine has sustained by the strangulation, so the amount of damage the bowel has received is to be measured by the intensity of the strangulation and the period of its duration. A tight unyielding strangulation, such as usually exists in a femoral hernia, does more harm in a short period, than a less tight and more yielding constricting force, such as is met with in inguinal hernia, in a longer period; violent taxis adding materially to the danger of the case.

The existence of peritonitis before the reduction of the hernia is always a more unfavorable sign, for it is not likely to be lessened by the introduction into the peritoneal cavity of a bowel already inflamed and altered in character. A hernia that has not been strangulated for many hours, that has not been injured by violent manipulation, and has been reduced by the "minor" operation in an otherwise healthy subject will probably do well, when another that has been strangulated for days, or has been subjected to violent taxis will probably do badly.

Where disease of the kidneys or of other viscera exist the prognosis is always unfavorable, and in old people the same opinion must be formed.

A free exposure of the intestine is more unfavorable than where no exposure has taken place, and any excessive manipulation of the hernial contents always adds to the danger.

A severely damaged intestine is more liable to be followed by a bad result

than where little injury exists, but a slightly injured bowel in an aged or unhealthy subject is always likely to end badly.

A recent hernia requiring operation is always far more fatal than an "old case."

In private practice where herniæ are, as a rule, discovered and treated early, good success follows herniotomy, but in hospital practice where neglect and delay combined have had their influence, the success of treatment is very bad, about half dying. At Guy's Hospital the average period of strangulation for femoral hernia is seventy-six hours, of inguinal fifty; and half the cases that die after the operation do so within forty-eight hours, the injury to the bowel being so great and the power of the patient so reduced, that any reaction after the reduction of the hernia is rendered impossible, and under these circumstances the worst that can be said for the operation is that it fails to relieve.

CHAPTER XXXIII.

INGUINAL, FEMORAL, UMBILICAL, OBTURATOR, AND OTHER HERNIÆ.

INGUINAL HERNIA, or that form which protrudes through the internal or external abdominal rings, includes two-thirds of all cases of hernia, and about half of all cases of strangulated hernia. Two out of three cases of strangulated inguinal hernia are reducible by the taxis; the third requiring operation. In hospital practice, half of those operated upon die; operations in recent cases are most fatal.

An inguinal hernia is called *oblique* when it passes through the internal ring and the inguinal canal downwards towards the scrotum; *direct*, when it does not pass through the internal ring, but through the external in a direct way.

The oblique being also anatomically placed external to the internal epigastric artery, is called *external oblique*, and the direct from being internal to the same vessel is known as the *internal direct*.

When the oblique has not passed the external ring, it is known as a *bu-bonocoele*; when the oblique or direct has passed into the scrotum, it is called a "*scrotal hernia*" or "*oscheocoele*."

In the *oblique inguinal*, the sac of the hernia may be the natural "vaginal process of peritoneum" that was formed on the descent of the testicle in foetal life, and has not closed, or the "*congenital sac*" (Figs. 161-2-3, p. 324); or an *acquired sac* formed by the gradual pouching of the parietal peritoneum through the ring (Fig. 165).

In the *direct inguinal*, the sac is always of the acquired form.

This "vaginal tubular process of peritoneum" that communicates above at the internal abdominal ring with the peritoneal cavity, and below is in close contact with and adherent to the testicle, lies in front of the spermatic cord, and before birth, or soon after, "it contracts near the head of the epididymis, its surfaces adhere firmly at that spot, and thus two cavities are formed." The inferior one forms the permanent covering to the testis, and is known as the *tunica vaginalis propria testis*. The superior canal, when no arrest of development takes place, subsequently contracts, this action commencing at the internal ring, till the canal ceases to exist.

When an arrest of development occurs, and the abdominal orifice of the

tubular process remains patent, a piece of intestine may at any time descend. When the whole length of the canal is open, the hernia will pass down at once into the scrotum to the testicle, covered with its serous membrane masking its presence, and in this way the "*congenital hernia*" of Haller, the "*hernia of infancy*" of Malgaigne, or the "*hernia into the vaginal process of peritoneum*" of Birkett, is formed (Fig. 161).

When the closure of the canal takes place higher up—for such an event is possible at any point from the testicle upwards—the descent of the hernia will be limited, but its nature is the same, the only difference being, that in this condition the testicle will be found below the hernial sac at a variable distance, and separated from it. To this form of rupture Birkett has given the name of "*hernia into the funicular portion of the vaginal process of the peritoneum*" (Fig. 162).

It must also be mentioned, that it is not uncommon for this tubular vaginal process to close at its abdominal orifice at the internal ring, and yet remain more or less open as a cavity below; and, under these circumstances, any sudden rupture or giving way of the closing medium will be followed by the rapid formation of a hernia, the hernia being scrotal, wholly or in part, lying upon or separated from the testicle, according to the absence or position of any point of closure. This form of hernia differs only in the sudden giving way of the abdominal orifice of the vaginal process from those last described. It is very common in young adults.

To all these forms of hernia in which the sac is composed of the natural tubular vaginal process of peritoneum, the term "*congenital form*" of hernia would probably be the best, as indicating their nature, distinguishing them from the other form rightly called the "*acquired*."

This congenital form of hernia is also frequently associated with some malposition of the testicle, its non-descent or partial descent.

The "*infantile hernia*" of Hey, or the "*encysted hernia of the tunica vaginalis*" of Sir A. Cooper, is an acquired hernia; the hernia gradually pushing the tissues closing the orifice of the vaginal process of peritoneum downwards into the open canal, the protruded parts together with the sac being contained in the tunica vaginalis testis, and the true sac being within that which might have been the congenital (Fig. 164).

The hour-glass contraction of a scrotal hernia is always found in the "*congenital form*." It is due, as described by Birkett, to the imperfect closure of the vaginal sheath at that part where union of its walls normally takes place, that is, above the testicles. Prep. 2368 in the Guy's Museum will explain these cases, likewise Fig. 163.

The acquired form of inguinal hernia, oblique or direct, is always slow in its formation, the pushing downward of the parietal layer of peritoneum by the protruding viscera being a gradual process, thus forming a marked contrast with the congenital form in all its varieties. In the oblique it begins as a slight yielding at the internal ring, and in the direct at the external, this yielding passing into a "pouching," till at last the pouch may reach and even fill the scrotum. In the early stage, this yielding may hardly be perceptible, but to the patient it will give rise to a feeling of weakness, and often of pain, on any abdominal muscular exertion being made. When a "pouching" has commenced, any act of coughing or straining will make it visible. Malgaigne has described this as a pointing of the hernia.

When the oblique hernia has filled the inguinal canal, it will appear as an ovoid swelling in the part above Poupart's ligament (*vide* Fig. 170), beneath the tendon of the external oblique muscle. When it has passed through the external ring, the long axis of the tumor, and more particu-

larly its neck, will still be in the inguinal canal, and lie above and parallel with Poupart's ligament. It will, however, have escaped from beneath the external oblique muscle, and form a pyriform tumor of variable size. The testicle will always be found below and distinct from the sac, the cord being behind the tumor.

In the *direct* inguinal form the pouching of the hernial sac is directly behind the external ring (Fig. 171); it has no inguinal neck, such as the oblique, but comes direct through the external ring down into the scrotum. It has a more globular shape than the oblique.

When the *oblique* inguinal is reduced, the surgeon can pass his finger through the external ring, along the inguinal canal, upwards and outwards into the internal ring, and thus into the abdominal cavity. In old herniæ the two rings are brought closer in apposition than natural. In *direct* inguinal, the finger having passed the external ring, seems to enter at once into the abdominal cavity, the opening being directly behind the external ring. It has no neck directed outwards and upwards, such as exists in the oblique form; with the finger passed through the neck, the external border of the rectus muscle may be felt, on the pubic bones. By these points the *diagnosis* between the acquired oblique and the direct inguinal is to be made out.

A few words are, however, needed to mark the points of difference between the "congenital" and "acquired" form of the oblique inguinal, and in this, the history of its formation is the most important. When it has formed suddenly, and has passed at once into the scrotum, it is probably the "congenital form;" when it has been produced slowly, the "acquired." When it envelops the testicle, and renders its detection impossible or difficult, the "congenital form" is indicated. When the testicle is in its right place and distinct from the hernial sac, the hernia is "acquired."

A hernia with a long tubular neck occupying the inguinal canal is probably of the "congenital" kind, a short, thick neck being more common in the "acquired."

An hour-glass contraction of the hernia always points towards the congenital form, as does any malposition of the testicle in the side affected (*vide* Figs. 161 to 164).

The congenital form is *the* hernia of infancy and young adult life, the "acquired" *the* hernia of middle and old age.

The youth of the patient, the rapidity of its formation, and its close connection with the testicle, are the three chief points characteristic of the "congenital" form of hernia in all its varieties. The age of the patient, the slowness of its production, and its distinct separation from the testicle, are the three points indicative of the "acquired" hernia.

The diagnosis of an inguinal hernia from other tumors is only difficult in exceptional cases. No scrotal tumor that begins from below in the scrotum or testicle and develops upwards can be hernia, for all herniæ descend towards the scrotum. Thus, when a distinct separation exists between the scrotal tumor and the external ring no difficulty ought to exist. In this way ordinary hydroceles, hæmatoceles, and all diseases of the testicle are excluded.

When a *hydrocele*, however, passes upwards through the external ring, and even to the internal ring—a condition by no means uncommon in infancy and young adult life—when the vaginal process of peritoneum is only closed at its abdominal orifice, some difficulty may be experienced; but the absence of all symptoms of hernia, the history of the case, that the swelling began below and travelled upwards, and its general translucency, will indicate the nature of the affection.

Congenital hydroceles into the vaginal process are to be distinguished from congenital hernia by their being transparent, by the gradual filling of the sac, and by their vibration on percussion. A hernia is opaque, it enters the sac rapidly, and leaves it quickly, and does not vibrate.

An *encysted hydrocele* of the cord appears as a tense-fluctuating transparent tumor, and is irreducible; it ought not to be confused with a bubonocoele when no general symptoms of hernia, beyond the swelling, exist.

The wormy feel of a *varicocoele* or varicose spermatic veins ought to prevent it being mistaken for a hernia; but the fact, that pressure over the external ring sufficient to keep any hernia in position with the patient erect, renders the varicose veins more marked, should prevent any error being committed.

And if the surgeon would only look for the two testicles in every case of scrotal, or even inguinal swelling, he would never fall into the error of mistaking an undescended testicle, or one resting at the internal ring or in the inguinal canal, for a hernia, or any other disease.

When a hernia and hydrocele coexist some difficulty may be experienced in the diagnosis, but the symptoms of each affection being separate the diagnosis can hardly be very difficult.

But whenever doubt in diagnosis is experienced, and symptoms of a strangulated hernia are present, with an inguinal tumor, the golden rule in surgery ought to be observed and the doubtful tumor explored.

I have recently (Feb., 1872) had, with the Messrs. Toulmin, of Clapton, an interesting case, illustrating this, in a boy, æt. 4, who had an acute hydrocele associated with a sudden descent of a hernia into the vaginal process of the peritoneum of the cord. I tapped the hydrocele and left the inguinal tumor, thinking that it might possibly be a hydrocele of the cord, as no symptoms of strangulated bowel were present. As soon as they appeared, chloroform was given with the view of exploring the tumor, when, by the taxis, it was happily reduced. The boy did well.

Inguinal hernia in the female child is very common; under puberty it is the usual kind. It is always of the "congenital form," the bowel coming down into the open canal of Nuck. It is found, however, at all periods of life; as a direct hernia, it is only seen in the adult. The rupture, at times, descends into the labium. It is to be recognized by the same symptoms as are found in the male. A hydrocele of the same canal may be mistaken for it. It is to be treated on the same principles.

TREATMENT.—A reducible inguinal hernia is to be kept up with a truss, whether in the infant child or adult; the truss must also be *well fitting*. Sufficient pressure to keep the hernia in position is wanted, *but no more*. Should the hernia come down when the truss is on, it should be reduced, and the truss reapplied. The pressure of the pad in the oblique form should be over the *internal ring*; in the direct, over the *external*. In infants, a complete cure is often obtained by these means in a year or so, and should no descent show itself for another year, or any symptom of hernia, the truss may be left off; but in any case of hernia occurring after infancy, it is never safe to leave off the truss. In the congenital form of hernia, when some malposition of the testis complicates the case, the pad of the truss must not press the testicle. When the testicle and hernia are both in the inguinal canal, no truss can be tolerated. In all congenital herniæ the surgeon should look to this, for many patients are caused severe pain by the neglect of this precaution.

Irreducible, inflamed, obstructed and strangulated inguinal herniæ are to be treated on the principles already laid down.

When a hernia cannot be kept up with a truss, the question of the opera-

tion for the *radical cure* of the hernia may be entertained, but under no other circumstances, for the operation has its dangers, and Wutzer, its early advocate, admits, that a truss is necessary for life subsequently.

The *radical cure of a hernia* has been the aim of surgeons from time immemorial; and were hernia only a mechanical lesion, its causes existing in the weakness of the walls through which it protrudes, and in the neck of the sac alone, some success would probably have attended the practice; but as a rupture is more probably due to the elongation of the mesenteric ligament of the intestine than to those already named, it can hardly be expected that any very good result should have been obtained. Gerdy, Wutzer, Rothmund, Wells, and Davies, have all tried to do this by plugging the mouth of the sac with its fundus, which has been invaginated for the purpose. Gerdy fixed the invaginated fundus by means of two sutures; Wutzer by means of a cylindrical wooden plug passed into the inguinal canal in the hollow of the invaginated structures up to its neck, and a grooved wooden pad applied externally over the first to hold the parts in position, the two being held together by a needle inclosed in the cylindrical part, and made to pass through the internal ring and external tissues, and a screw, the plug being retained for six or seven days. Rothmund, Wells, Davies, and others, have only improved upon Wutzer's method. Mr. Birkett, however, tells us, on the authority of Dr. Otto Weber, of Bonn, the late clinical assistant to Wutzer, that Wutzer is still of opinion that his operation is not a dangerous one when properly performed, and that by his method the fundus of the invaginated sac may be made to adhere to its neck, and that, in consequence of this, *if the patient continues to wear a truss for life a return of the hernia may be avoided*. Dr. O. Weber, however, writes, that he has never seen any of the so-called "cured cases" radically cured; that the plug of skin is by degrees entirely drawn out again; that the external and internal rings are not closed by the operation; that an imperfect cure may be effected by means of a partial closure by adhesion of the internal walls of the neck of the sac, and thickening of the surrounding tissues. In London practice it is also well known that a fatal peritonitis has followed the attempt. With these facts before us respecting the so-called cure by invagination, and the knowledge that even when the cure has been effected, the wearing of a truss is still an essential point of practice, the subject may be dismissed as an operation that cannot be recommended.

Mr. Wood, of King's College, believing that Wutzer's principle of practice was as wrong as his practice was unsuccessful, in 1863 devised an operation, by which the hernial sac, without the skin, is invaginated into the canal, and the hinder and inner walls of the inguinal canal drawn forward by means of sutures, and fixed to the anterior and outer wall.

The steps of the operation are conducted as follows. They are taken from Druitt's *Vade mecum*, as revised by Wood:

The patient being laid on his back, with the shoulders well raised, and the knees bent, the pubes cleanly shaved, the rupture completely reduced, and chloroform administered, an oblique incision, about an inch long, is made in the skin of the scrotum over the fundus of the hernial sac. A small tenotomy knife is then carried flatwise under the margins of the incision, so as to separate the skin from the deeper coverings of the sac, to the extent of about an inch, or rather more, all round. The forefinger is then passed into the wound, and the detached fascia and fundus of the sac invaginated into the canal. The finger then feels for the lower border of the internal oblique muscle, lifting it forwards to the surface. By this means the outer edge of the conjoined tendon is felt to the inner side of the finger. A stout semicircular needle, mounted in a strong handle, with a

point flattened antero-posteriorly, and with an eye in its point, is then carried carefully up to the point of the finger along its inner side, and made to transfix the conjoined tendon, and also the inner pillar of the external ring. When the point is seen to raise the skin, the latter is drawn over towards the median line, and the needle made to pierce it as far outward as possible. A piece of stout copper wire, silvered, about two feet long, is then hooked into the eye of the needle, drawn back with it into the scrotum, and then detached. The finger is next placed behind the outer pillar of the ring, and made to raise that and Poupart's ligament as much as possible from the deeper structures. The needle is then passed along the outer side of the finger and pushed through Poupart's ligament, a little below the deep hernial opening (internal ring). The point is then directed through the same skin puncture before made, the other end of the wire hooked on to it, drawn back into the scrotal puncture, as before, and then detached. Next, the sac at the scrotal incision is pinched up between the finger and thumb, and the cord slipped back from it, as in taking up varicose veins. The needle is then passed across behind the sac, entering and emerging at the opposite ends of the scrotal incision. (Fig. 181.) The end of the inner wire is again hooked on, and drawn back across the sac. Both ends of the wire are then drawn down until the loop is near the surface of the groin above, and are twisted together down into the incision, and cut off to a convenient length. Traction is then made upon the loop. This invaginates the sac and scrotal fascia well up into the hernial canal. The loop of wire is finally twisted down close into the upper puncture, and bent down to be joined to the two ends in a bow or arch, under which is placed a stout pad of lint. The whole is held steady by a spica bandage. (Fig. 180.) The wire is kept in from ten to fourteen days, or even longer, if the amount of consolidation is not satisfactory. Very little suppuration usually follows, but after a few days the parts can be felt thickened by adhesive deposit. The wire becomes loosened by ulceration in its track, until it can be untwisted and withdrawn *upwards*. In this operation the hernial canal is closed along its whole length, and an extended adherent surface is obtained to resist future protrusion.

After the operation, Wood says, a horseshoe pad should be worn for a few months, and *when the patient is about to be subjected to violent strains or lifting, the truss is not to be thrown aside*. This is important to bear in mind; it tends, however, much to do away with the value of the operation.

Modifications of the operation are employed for infants, &c.

The ingenuity of this operation is great, and *where the radical cure is called for* it should be employed. Wood says he has operated 155 times with two deaths, 40 failures, and 113 satisfactory cures. Thus, in the most favorable light there is one failure to two successes, and a risk to life. It is to be feared, however, that a large number of these so-called satisfactory cures are only so when they leave the operator's hands, for Kingdon's Reports of the City of London Truss Society tell us that within the last ten years fifty cases have applied for trusses who had undergone some operation for the radical cure in consequence of its failure, and this number is a

FIG. 181.



From Wood.

large one, considering the surgeons who perform this operation are not numerous, or the cases abundant.

For my own part, I believe that where a hernia can be kept up by a truss, and the patient is likely to remain in a civilized country where trusses can be obtained, any operation for the radical cure is an unjustifiable one: to risk the life of the patient on the theory of a cure, with the probability that the patient will be rendered less liable to its descent, when a truss has to be worn subsequent to the operation as a matter of safety, is a practical delusion.

When a hernia is reducible, and yet cannot be kept in place by a truss, when a patient is going abroad where trusses are not to be obtained, or only obtained at too great a cost, the operation for the radical cure may be performed. Under these circumstances I have undertaken Wood's and Wutzer's operation in some few cases with good success; that is, the patients who could not keep up their hernia previously on account of the great size of the inguinal ring were enabled to do so. Under all other circumstances I have refused to undertake it.

In the "congenital form" of inguinal hernia there seems a better prospect of success to the operation than in any other, and a better theory for the practice; for "thus allowing nature to guide our procedure, we must make it a rule to select those cases in which her efforts have failed; and by acting as her handmaid, we may reasonably hope to arrive at a successful result." (Birkett.)

The treatment of strangulated inguinal hernia and the operation have been already given.

Femoral Hernia.—This forms about one-tenth of the whole number of cases of hernia, and about forty per cent. of all cases of strangulated hernia. One out of three of the cases of strangulated femoral hernia are reducible by the taxis, two being operated upon, and of the cases operated upon 40 out of every 100 die, the operation after "recent" hernia being twice as fatal as those upon the "old." Femoral hernia is far more liable than inguinal to become strangulated, and less liable to reduction by the taxis. The taxis also is more prone to produce injury. A strangulated femoral hernia goes on more rapidly to destruction than any other, and a strangulated "recent" hernia than one of "old" date.

Femoral hernia descends from the abdominal cavity through the crural ring *beneath* Poupart's ligament, to the inner side of the femoral vessels. The free margin of Gimbernat's ligament bounds its inner side, as the sac, which is always an acquired one, and composed of peritoneum, pouches downwards beneath Poupart's ligament, and emerges through the saphenous opening to the inner side of the falciform process of the fascia lata; it expands laterally, and rests upon this fascia; as it enlarges it turns upwards over Poupart's ligament, and in the direction of the crest of the ilium, very rarely spreading downwards. Its long diameter will be transverse, and not vertical. The neck of the hernia will always lie *outside* the spine of the pubes, or the tendon of the long adductor, while an inguino-scrotal or labial hernia will always be found *inside* these points. The internal epigastric artery and vein usually lie outside the neck of the sac, and free from harm in the operation; but when the obturator comes off from the epigastric, and arches over the neck of the hernia to dip down on its inner side towards the obturator foramen, it may be divided when a *free* incision is made.

Rare cases of femoral hernia occur external to the femoral vessels, as related by Partridge ("Path. Soc." vol. i), and others through Gimbernat's

ligament, or with a diverticulum through the cribriform fascia or superficial fascia. (*Vide* Birkett.)

Diagnosis.—The points already given will enable the student to distinguish a femoral from an inguinal hernia, and the great depth of an *obturator* hernia, with the fact that in this form the crural ring is *not* obstructed as it would be in a femoral hernia ought to distinguish it.

A *psoas abscess* dilates in coughing, and disappears or diminishes on the patient lying down, just as does a hernia; but it is usually placed beneath and outside the vessels instead of inside. It is accompanied by other symptoms, often spinal; and on manipulation gives the sign of fluctuation from above to below Poupart's ligament.

A *varix of the femoral vein* may also in a measure simulate a hernia; but whereas in a hernia pressure over the crural ring and vessels, with the patient erect, will prevent its descent, in varix it will cause its enlargement.

An *enlarged gland* ought not to be mistaken for a rupture, for the history of the case and concomitant symptoms generally mark its nature.

Cysts in the crural ring are doubtless difficult to diagnose, although from their always being in the same spot under all circumstances, and from their not being influenced by position, coughing, &c., they are unlike hernia. When associated with a strangulated hernia they may complicate, but hardly lead to error in the case.

TREATMENT.—Reducible herniæ are to be treated by a truss, the pad pressing in the hollow below and external to the spinous process of the pubes. The radical cure has been performed by Wood, Wells, and Davies, but it cannot be recommended.

Strangulated Femoral Hernia requires the most prompt attention, for the parts constricting the neck of the sac are so unyielding as to produce in a short period an amount of damage which is too often irreparable.

The *taxis* in femoral hernia is not only less successful in effecting its reduction, but more fatal than in inguinal hernia. In applying it the utmost gentleness should be employed, and the administration of chloroform should always precede the attempt. In the reduction of an old femoral hernia the *taxis* rarely succeeds.

In reducing a femoral hernia by the *taxis*, the surgeon should always remember the position of the orifice of the sac, for when it has turned over Poupart's ligament any pressure upon the tumor can only do harm. The tumor should be gently raised by the fingers, and drawn slightly downwards before pressure is applied, backwards and upwards, and this must be of the mildest kind. Should the slightest disposition to yield be shown, the pressure may be continued, for when any of the contents of the sac are emptied, the probabilities of the reduction of the whole are greatly enhanced. Should no yielding be felt in the parts, the *taxis* had better be given up, and the operation performed.

In all operations for femoral hernia the reduction of the hernia, without opening the sac, should be preferred, and in "recent" hernia this "minor" operation is generally successful. The incision to expose the sac should consequently be a limited one. Luke suggested that "a fold of integuments is to be pinched up and divided by transfixing it with a narrow blade, so that the incision, when the skin is replaced, shall fall perpendicularly to the body, with its centre opposite to the depression, which indicates the seat of strangulation." But this plan is in a measure dangerous, for I have seen Mr. Key with the point of his knife divide all the tissues outside the sac, and the sac itself in perforating the skin-fold.

Mr. Gay advises "an incision rather more than an inch long to be made near the inner side of the neck of the tumor." The superficial fascia to be

divided, and a director or *bistouri caché* introduced down to the neck of the tumor, and through the crural ring, "by the least amount of force, and with the aid of a little gentle compression of the inner side of the tumor by the finger, the point of the bistoury may be insinuated between the sac, or rather fascia propria, and the pubic margin of the ring; the edge of the knife is then to be turned towards the pubes, and by projecting the blade the seat of stricture in that direction may be effectively divided." When a director is used, or the finger, the ordinary hernia knife may be used in the same way.

Nothing can be more satisfactory than this operation when reduction is effected by it; it should always be attempted. Should it fail, and the sac has to be opened, no harm can possibly have been caused by the proceeding, for the incision can readily be enlarged, if necessary, the sac opened, and its neck divided. Any modification of the incision may, however, be made. The essential point is, that the incision should be of such a nature as to allow the surgeon to reach with facility the neck of the tumor. In operating, the surgeon must also remember the fascia propria or fascia that is external and superficial to the sac; it will always appear as a well-defined sac upon the division of the soft parts that cover it in, and may be mistaken for the true sac. On its division a layer of fat will often be found, more or less lobulated; this is the subperitoneal fat, and beneath this will be found the true peritoneal sac. In Gay's operation, as already described, the parts outside the fascia propria have been divided, and the division is commonly sufficient to allow of the reduction of the hernia; when it has failed, and the sac has been exposed, there is no objection to the surgeon again dividing the neck upon a director, and should this fail, the sac must be opened. The flow of a stream of serum will probably attend this step, and, as previously stated, the nature of the fluid will indicate the condition of the parts within; the sac should be freely opened. When only intestine is seen, the director may be carefully introduced into the neck of the sac, and the constricting orifice divided, the intestine being only touched, and the gentlest pressure will then reduce the bowel. Should omentum cover the bowel, it is to be carefully raised and unravelled. Should an omental sac exist, it must be torn through or carefully divided, and dealt with as previously explained. The less the parts at the neck of the sac are disturbed the better; no introduction of the finger beyond the neck of the sac is necessary, no passing of the director or hernia knife beyond the neck is called for. The neck of the sac should be divided outside the omentum. When the neck of the sac has been divided, and the sac has to be opened subsequently to insure the reduction of the contents, it is seldom necessary to reintroduce the bistoury, the parts yielding to the finger enough to allow of the replacement of the hernial contents, for the less the neck of the sac is divided the better. The surgeon should always be careful that the hernia is not reduced within the crural ring, together with the sac; if so, the sac must be brought down again, opened, and held *in situ* whilst its contents are returned. The after-treatment of the case is to be based upon the same principles as have been already laid down.

Obturator Hernia, or hernia through the foramen of that name, deserves a passing notice, for its successful treatment can only follow its diagnosis. It is more common in females than males, and is often unattended by any external evidences of its existence. Birkett has collected twenty-five examples of this affection; in fourteen the hernia was not discovered till after death. In three only was a successful operation performed; by Obré in

1851, Bransby Cooper in 1853, Lorinson in 1857. Mr. Cooper's case I had the good fortune to see.

The sac of the hernia is always an "acquired" one; it emerges in the thigh between the adductor longus muscle and femoral vessels, beneath the pectineus muscle. The hernia is consequently on a lower level than the femoral, and comes forward instead of downward. But a tumor is not always to be felt under these circumstances, and a diagnosis is to be made out of the general symptoms; and of these, pain in the course and distribution of the obturator nerve is the most marked. In several of the recorded cases, during the development of the hernia, the pain described as "spasmodic contraction of the abdominal muscles" was most marked, and this fact is explained by Birkett by recalling the association existing between this nerve and the muscular filaments distributed on the abdominal muscles, all being branches of the lumbar plexus. Birkett also notices that movement of the hip-joint in the affected side excites or aggravates the pain, as well as deep local pressure; and pelvic examination, either per vaginam or rectum. With these symptoms associated with those of strangulated hernia, an exploratory operation in the region of the hernia is justifiable, should the taxis fail.

TREATMENT.—The taxis can hardly be expected to be a successful proceeding in obturator hernia, the sac being so low down in the thigh and so little under control. Nevertheless, it should be tried, with the adductors relaxed, by means of steady pressure applied downwards in the hollow of the thigh, and inwards between the adductors.

To explore the parts an incision should be made below Poupart's ligament, and to the inner side of the femoral vein, down to the pectineus muscle; this may then be divided. Should no sac appear, and the obturator foramen, covered by its muscle, reached, the fibres of this muscle must then be separated, and the obturator canal felt; for a small hernia may be well hidden by the muscle. Should a sac be felt, the parts constricting it must be divided by a knife, and its contents reduced. The obturator nerve should not be wounded, if possible.

Umbilical Hernia.—This is a common affection in children from a want of closure of the umbilicus; in fat women, and in others who have had many children, it is far from rare. In men it is also met with; it forms 5 per cent. of all cases of hernia, and 6 per cent. of cases of strangulated hernia.

The *sac* of this form of hernia is an acquired one; it is always formed, both in the infant and adult, by the pushing forwards of the parietal abdominal layer of peritoneum. The parts covering it in are only integument and fascia, the internal abdominal fascia being over the true sac; these parts are occasionally very thin. The tumor at times attains a large size, but it always increases *downwards*; thus the surgeon must look for the neck of the sac at its upper part; these herniæ assume odd shapes.

TREATMENT.—When reducible, and in an infant, a cure may with some confidence be promised; indeed, in the majority of cases in young life the opening in the navel will contract, if care be observed to keep on a flat elastic ring or pad covered with leather, and fixed on with good strapping. A belt or truss in early life is a delusion, it never keeps its place. If the pad be made convex, it tends to keep the ring open; the aim of the surgeon is to prevent protrusion, and assist the closure of the orifice by keeping its edges together. Messrs. Lee, Barwell, and Wood have carried out this last object by means of an operation, but such a measure cannot be recommended; to risk life unnecessarily for an affection that is mostly curable by means of time, and natural processes assisted by art, is hardly justifiable.

Adult patients with reducible ventral hernia should also wear some mechanical appliance, such as a ring truss; and an irreducible rupture should be protected by a cup truss.

When these ruptures are large and irreducible, they give rise to abdominal symptoms of some trouble. They are apt, indeed, to be the best examples the surgeon sees of so-called obstructed hernia; fæces and flatus get into the strangulated intestine and cannot get out, thus causing nausea, colic pains, and constipation. Rest in the horizontal position, a good enema to empty the lower bowel, and a purge to clear out the upper, will often, under these circumstances, prove of great benefit. At any rate such means should be tried in all cases.

When general symptoms of strangulation exist together with local signs, such measures must not, however, be thought of. When vomiting, constipation, local pain, and an absence of impulse in the tumor are persistent, the reduction or freedom of the mass from strangulation by operation must be entertained.

With a patient under chloroform the taxis, as a rule, proves successful. In applying it to a large tumor, where it is probable a fresh descent of intestine has taken place, and the symptoms are due to its strangulation, the surgeon should examine the tumor carefully, to make out if one part be more tense than another; for if it be, the taxis should be applied to the tense part in preference to the other. On several occasions, by adopting this practice, I have been able to reduce the strangulated portion of the contents of a hernia with complete success.

Should herniotomy be called for, it is a matter of immense importance that no manipulation of the contents of the sac should take place. When the sac is opened and the parts exposed, it is an exceptional occurrence for any cure to follow, no cases of hernia being more fatal than the umbilical under these circumstances. When the sac is not opened so as to expose its contents, or only opened at its neck, to allow of the division of the strangulating orifice, a good result may be looked for.

In four cases, in which I have adopted this practice, a good result followed, the oldest patient being seventy-four years of age, and the strangulation of five days' standing.

In irreducible hernia of large size and of long standing, when reduction of the contents of the sac, as a whole, cannot be expected, and there is no evidence of strangulation within the sac by some of its contents, the surgeon should be satisfied by dividing the neck of the sac, and thus relieving the strangulation, he may then by gentle taxis reduce what will return, but he should do no more. To explore the whole sac, and to expose the irreducible bowel to the air and to manipulation, is an unnecessary practice. Every surgeon knows how fatal it is. At times a double sac is found in umbilical hernia. Some time ago I was called upon to operate in such a case. The woman was aged 44, and had been ruptured for years, the hernia being irreducible. She came under my care at Guy's, with symptoms of two days' strangulation. The rupture was clearly inflamed, not the slightest manipulation being tolerated. Under chloroform I cut down upon the tumor, and found two distinct sacs, their orifices placed laterally, being separated by a piece of dense fibre tissue. One contained a mass of sloughing omentum, the second, intestine, which was black from congestion, and covered with lymph. The contents of each were reduced separately on incising the orifices of the sacs; the patient died, and no examination after death was allowed.

In another case I found a strangulated bowel in a small omental sac, introduced into an irreducible hernia.

A Ventral Hernia is a term applied to any protrusion through the abdominal walls, not belonging to the usual forms. The majority are found in the linea alba above the navel. One of the largest I ever saw was over the right iliac fossa, following a rupture of the abdominal muscles, from a fall of twenty feet upon the handle of a pump. It was the size of a man's hand, and strangulated. By the taxis I reduced the mass, and under ice locally, and opium internally, the man recovered. He had, however, to wear a pad subsequently to support the part.

After the operation of ovariectomy a very large protrusion will take place if a good belt be not worn.

The same may arise after the weakening of the abdominal walls from abscess.

When the hernia takes place below the xiphoid cartilage it is called *epigastric*.

When it takes place in the loins, *lumbar*. Birkett quotes two such cases.

Perineal Hernia descends in front of the rectum; it is most common in women; it appears in the perineum. When the hernia descends outside the vagina along the ramus of the ischium, it shows itself in the labium, *labial* or *pudendal hernia*; when it appears in the vagina, *vaginal hernia*.

Vaginal and labial herniæ may be mistaken for the mucous cysts of those parts; but the herniæ are reducible, and when irreducible or strangulated, they give rise to symptoms indicative of these conditions. The cysts are only local affections, they cause no general symptoms; they are tense, elastic, globular tumors, fixed in the tissues, and have *no neck* passing upwards into the pelvis.

Ischiatic Hernia is a hernia through the sciatic notch, above or below the pyriformis muscle. The gluteus maximus muscle covers it in; but as the hernia enlarges, it may appear below the lower border of that muscle. Should such a rupture become strangulated, an operation must be performed, the surgeon making such an incision as will best expose the tumor with its neck.

Diaphragmatic Hernia is also a surgical affection, and when the result of an accident it is generally fatal; it has been alluded to under the heading of "Abdominal Injuries" (p. 285).

It may also be the result of some congenital defect, or the pushing of the abdominal viscera through one of the natural openings in the muscle.

CHAPTER XXXIV.

ON TRUSSES.

A TRUSS is an instrument employed for the purpose of preventing the descent of a hernia. It is composed of a pad, to be placed over the seat of the hernial protrusion, and a spring or belt to keep it in position. Any truss that will keep up the hernia under all circumstances, and does not cause pain or lasting discomfort, is probably a good one. Every truss that fails to carry out this object must be condemned. An instrument with a too feeble spring is a delusion and a snare; an instrument with too powerful a one may tend to do more eventual harm than present good, by causing absorption of the abdominal parietes upon which it presses, and, as a con-

sequence, enlargement of the opening through which the hernia descends; for the same reason a very convex pad is also to be condemned.

A truss that will keep up one hernia may fail to do so in the case of another. Every hernia, in fact, requires a special adaptation of the pad, and a carefully regulated spring.

Every subject of a hernia, young or old, male or female, should wear a truss, and in a good proportion of cases, particularly of the young, a cure may take place; that is, the neck of the sac may close. But even after a cure, or apparent cure, has taken place, it is well, for the sake of safety, to wear the instrument; for cases are far from infrequent, when a supposed cure had taken place, and after the lapse of years, a sudden descent has occurred, jeopardizing life. In the congenital form of hernia this is the more common.

The truss should be worn all day, from the act of rising out of bed to that of retiring, for its object is to prevent the descent of the hernia under any sudden act of exertion, and with the truss off it is impossible to guarantee that any such may not be made. The habit some patients have of taking off their trusses when they are sitting in their drawing-room is one to be condemned, for I have more than once been called upon to treat a strangulated hernia which came down under these circumstances, during some unguarded act; and it is in this unguarded moment that the truss is calculated to be of use.

When the truss is first applied it will doubtless cause inconvenience, but this will soon pass away. The use of plenty of starch or violet powder, the bathing of the point of pressure with some spirit and water, and attention to keep it very dry, remedy any little local source of discomfort.

The Pad.—This should be regulated according to the size of the hernial aperture. A small opening requires a small pad; a large opening, a large one. The pad should always overlap for about half an inch all round the hernial aperture, and in large herniæ more. The pad should be slightly convex when made of any yielding material, and flat when of a firmer consistency. It should also be so adapted to its spring as to keep its place under all circumstances.

It should also, in inguinal hernia, be so fixed to the spring as to exert a pressure at right angles to the plane of the hernial aperture. Thus, in large pendulous bellies, the pressure may be upwards, or inwards and upwards; in thin subjects directly backwards. In femoral rupture the pressure should always be backwards, to close the crural ring. Any truss that applies its pressure only in one direction must fail in its purpose in a large number of cases. It is, indeed, in this curve of the spring, or direction in which the pressure of the pad is employed, that the chief difference in the great varieties of trusses is found.

Some pads are rigidly attached to the spring that holds them in position, while others are connected by means of movable joints of different construction. Salmon and Ody's well-known truss has a ball and socket joint.

The **spring** of a truss is a point of importance, although it is not so important as the pad and the direction of the line of pressure. Its strength is to be carefully regulated according to the requirements of the individual case. It must be strong enough to keep the pad in position, and prevent the descent of the hernia under all circumstances, but not so strong as to cause pain. The French spring consists of a coil, like that of a watch-spring; it is always in action, and presses inwards. The German form is more rigid and inelastic; it holds the pad in its place, and resists the protrusion of the hernia under any expulsive effort. The English makers employ a variety of springs. A too rigid one, as the German, is not to be

recommended, whilst the French is likewise objectionable, as its action is too severe and too constant.

The best spring is one that holds the pad in position, keeps it there under all movements, counteracts any expulsive action of the hernia, and causes little if any discomfort. The lighter it is, under these circumstances, the better, and the closer it is adapted to the body the more comfort it affords.

The only truss that has no circular body spring, and is kept in position by a band, is the Moc-main lever. The pressure is kept up by means of a thigh strap attached to a small spring lever connected with the pad. Such a truss is comfortable, there is little doubt, for its action is not enough to produce discomfort, but it is not a safe truss under most circumstances. In old people, where the inguinal rings require only a little support, it may be used; but in the middle-aged, when the hernia has a tendency to come down, it is a dangerous and unreliable instrument.

In *oblique inguinal hernia* the pad of the truss should be placed *over the internal ring and canal*, not over the external ring, the object being to give support to the weak internal ring; in *direct inguinal* it is placed over the external ring. In *femoral hernia*, when the crural arch is natural and not relaxed, a small pad may be employed over the neck of the sac; when relaxed and movable, a large one, the pad being so adjusted as to press upon the ligament itself. After the operation of herniotomy for crural hernia, this point is worthy of attention; for when a free division of Gimbernat's ligament has been made, the neck of the sac is always large and the ligaments are relaxed.

To give a description of every variety of truss is needless.

Egg's truss is a rigid one in all respects, and keeps its place well when once fitted. *Coles's truss* is a very good one; it is light, and has a thin metallic pad covered with leather, and acted on by spiral springs. When properly adapted with a not too convex pad it gives a good elastic pressure, but it is not so well calculated to retain a hernia under violent exertion as another truss with a more solid pad; the elastic pad is apt to yield and allow the hernia to descend. This same objection applies to all elastic pads, although air or water pads in some cases are very comfortable and very valuable, particularly in the healthy aged subject.

Amongst the trusses with solid pads that of Wood's must be mentioned. They are made by Matthews, with flat pads, composed of wood, ivory, or vulcanite, an india-rubber water bag being occasionally applied to the surface of the pad. They are held in position by a spring that encircles the body. The size of the pad varies with the nature of the hernia and the size of the hernial aperture. For *oblique inguinal hernia* the pad is of an obliquely-curved horseshoe shape, the outer limb over Poupart's ligament being shorter than the inner, and the spermatic cord and pubic spine lying in the cleft. The curve of the horseshoe is placed over the inner hernial aperture. For *direct inguinal* or *umbilical hernia* the pad is made of the shape of an ovate ring with a hole in the centre, corresponding to the hernial opening. For *femoral hernia* the pad is egg shape.

Newsom's truss has a thin round wire spring and a hard pad, which is very comfortable when well adapted.

The truss of Dr. C. Edwards, of Cheltenham, is a good one, the pad being so arranged that it may revolve as well as slide on the spring when required. That of Salt's, of Birmingham, also, and L'Estrange's, are good instruments.

A simple and yet a very efficient truss has, for some time past, been made by Messrs. Krohne and Sesemann, designed by Mr. R. Rendle, surgical registrar at Guy's, for keeping up either a single or a double rupture.

It consists of a circular steel spring covered with vulcanite, and made to fit closely around the pelvis, one inch below the hip. In both ends of the spring a slot is made, in which slide vulcanite pads, one for the left and one for the right side, which are to support either a single or a double hernia. If a hernia exists on one side only, the spring pressure on that side is made the strongest, and the pad on the other side in these cases acts as a protection from rupture, to which persons ruptured on one side are predisposed.

But what I want the student to understand is, that a truss to be of use must answer to a nicety the purpose for which it is required. The pad is to be adapted to the abdominal hernial orifice, and not below it, or to the hernial tumor itself. The amount of pressure applied to the pad is to be carefully regulated as well as its direction, enough being employed to keep the pad in position under all circumstances, without causing pain. A slight force applied in the right direction is of greater value than a greater one misdirected.

The pad may be flat or slightly convex, and it may be made of a solid material; or, if of an elastic one, air, water, or springs may be employed, according to the requirements of the case. Sand pads are of great value, for they can be moulded to fit more comfortably and accurately than any other.

To Test the Value of a Truss.—The patient should be made to cough and strain, and when possible to jump; he should be placed on the edge of a chair with his legs apart, or made to stoop forward, with his knees apart and his hands resting on his knees, and then to cough, these positions tending more than any other to relax the lower parts of the abdomen and loosen the truss. Should the hernia by these means fail to descend, or should the coughing, &c., fail to excite in the patient a sensation of weakness in the part, the truss is probably an efficient one. But the surgeon, under all circumstances, should explain to his patient what the truss is expected to do, and point out to him the extreme danger he will incur should it fail to do it, and the necessity of again seeking advice.

The surgeon should, moreover, always take upon himself the responsibility of seeing that the truss fits, and not rest satisfied by sending his patient to buy a truss where he likes, and of what kind he likes. The surgeon should tell the maker what he wants, and not leave him to find it out.

To Measure for a Truss.—The following points should be noticed: The nature of the hernia, the size of the hernial aperture, the side, and if double. Give also the circumference of the pelvis, one inch below the hip-bone, and the girth of the body at the same line, commencing and ending at the hernial orifice, also the distance from the hernial aperture to the iliac spine. The surgeon should, moreover, always indicate to the maker the directions of the pressure required by the pad, and this is always to be made out when the patient stands by a digital examination. In pendulous and fat subjects, in inguinal hernia, it may be upwards, backwards, and inwards, in thin subjects simply backwards; but this is a point upon which no general rules can be laid down, and yet upon which the whole value of the truss depends. In femoral rupture the plane of the crural ring is horizontal, and it may be closed by a backward pressure. The surgeon should always look to this point himself.

To estimate the force required to keep the hernia in position is a difficult thing. Up to the present the only true test is that of trial. Mr. Wood has, however, recently had an ingenious pressure-gauge made for the pur-

pose, which may possibly turn out of value. ("Brit. Med. Journ.," October 12th, 1871.)

Patients who are apt at times to employ great muscular exertion should have two trusses, one for ordinary wear, with a sufficient press power to keep the hernia in position, and the second with an increase of power, the second one to be put on when occasion demands. They should also have extra bathing trusses.

When any tendency exists for a double hernia, as indicated by a bulging of the opposite ring or a sense of weakness on making exertion, a double truss should be worn, indeed, in inguinal hernia particularly, I am much disposed to think that a double truss should always be employed. It is as comfortable as, and often more comfortable than, a single one. It is an extra protection, and, if well adjusted, can do no harm.

Birkett, "Holmes's Syst.," vol. iv, ed. 1870; "Med.-Chir. Trans.," 1859.—*Bryant*, "Guy's Reports," 1856; "Clin. Surg.," Part 3, 1861.—*Cooper's* "Surgical Dict.," 8th ed.—*Gay*, "On Hernia," 1848.—*P. Hewett*, "Med.-Chir. Trans.," 1844.—*Hutchinson*, "Lond. Hosp. Rep.," 1865.—*James*, "On Hernia," 1859.—*Aston Key*, "On Hernia," 1833; "Guy's Rep.," 1842.—*Kingdon*, "Med.-Chir. Trans.," 1864.—*Tuke*, "Med.-Chir. Trans.," vol. xxxi; 1843, vol. xxvi.—*Lawrence*, "On Ruptures," 1835, 5th ed.—*Stephens*, "On Obstructed Hernia," 1829.—*Scarpa*, *Wishart's Ed.*, 1814.—*Ward*, "On Strangulated Hernia," 1854.—*Wood*, "On Rupture," 1863.

CHAPTER XXXV.

SURGERY OF THE ANUS AND RECTUM.

Malformations.—The anus and rectum are not rarely the seat of congenital malformations, and these show themselves in a great variety of forms. In one class of cases the anus is completely closed, the rectum being either partially or wholly deficient; in a *second* the anus exists in its normal condition, but opens into a *cul-de-sac*, the rectum being partially or wholly deficient; and in a *third* class the anal orifice is absent, the rectum opening into the bladder, urethra, vagina, or other abnormal position. And it will be observed, says Mr. Curling, to whom we are indebted for the bulk of our information on this subject ("Med.-Chir. Trans.," vol. xliii), that the classification of these imperfections is founded on states that can generally be recognized during life; but, unfortunately, the conditions of the terminal portion of the intestinal canal, and its relation to the parts around, cannot be predicated with any certainty. In cases of imperforate anus, or of anus opening into a *cul-de-sac*, the intestinal canal may terminate in a blind pouch at the brim of the pelvis, the rectum being wholly wanting; or an imperfect rectum may form a short sac, descending to the floor of the pelvis, or so low as the neck of the bladder in the male, or commencement of the vagina in the female. These malformations are also clearly due to some failure in the fetal development, for the anal portion of the bowel is developed independently of the upper portion. The two parts subsequently advance, and, in a natural condition, unite, the membranous diaphragm at the point of junction, at a later period, disappearing by interstitial absorption. When a failure in this process takes place, the second class of congenital imperfection is formed. Should the failure occur at an early period

of development, the two ends of the approaching tubes will be far distant, if at a later period they may be in closer contact.

Sometimes the blind pouch in which the intestinal canal terminates is connected with the anal integument, or with the anal *cul-de-sac*, by a cord prolonged from the bowel above, and it seems possible, from Curling's and MM. Goyrand and Friedberg's observations, that such cases are caused by an obliteration of the bowel, which was originally well formed, from some intra-uterine inflammatory action; some instances being recorded where the muscular tissue of the intestine was clearly traced.

FIG. 182.



Showing the intestine ending as a *cul-de-sac* above the anus. Prep. 1882⁷⁵, Guy's Hosp. Mus.

The closure of the anal orifice is due to a firm adhesion of the integument; where the upper bowel communicates with the urinary or vaginal passages, it is owing to the incomplete separation of the natural cloaca that exists in the development of those parts.

A clear understanding of the way in which these deformities are caused will explain the difficulties that are met with in their treatment.

TREATMENT.—The condition of every outlet of the body should be invariably examined on the birth of every child, and even when the anus appears normal, a digital examination should be made on the second day, when the bowels have failed to act, for many an infant's life has been lost for the want of this attention and the postponement of surgical relief till too late a period.

In the *simplest* cases, when the anus is closed by a thin membrane, and the bulging of the distended rectum indicates its nature, a cautious central incision through the soft parts should at once be made, and a good result is generally obtained, the power of the anus generally being complete.

In the *more complicated* cases, where the anus is closed or absent altogether and *no bulging of the bowel exists*, and where the surgeon has no means of making out the true position of the terminal end of the bowel, a cautious incision over the spot in which the anus exists or should exist may be made, but it must be carried out with care, the finger of the left hand acting as a pilot. The incision may be free as long as it is carried upwards and backwards towards the sacrum, and not forwards towards the urethra or vagina. It must not, however, be made too high.

Should these means fail, all further attempts must be given up. To introduce a knife or a trocar and canula blindly upwards, with the vain hope of puncturing the distended bowel, is a practice which must be unhesitatingly condemned. Indeed, Mr. Curling's figures prove that the perineal exploratory operation, unless undertaken with great care, does more harm than good; but when skilfully performed it is followed by good success.

In the treatment of the second class of cases, in which the rectum terminates above in a *cul-de-sac*, an exploratory operation may be made in the same way, and with the same care, as in the last, the same uncertainty as to the true position of the bowel rendering any operative proceeding hazardous. When the two tubes are in contact, and only separated by their membranous ends, as in the case illustrated (Fig. 182), a good result may be expected. When they are far apart no good can result. Mr. Curling gives in his table 31 examples of this class of cases. In 27 of these an attempt was made to reach the bowel, and in 16 with success; 10 of these subsequently recovered.

When the bowel is opened in any of these cases, and is not far from the anus, the surgeon should use all fair endeavors to draw down the intestine

to the margin of the external opening and fasten it with sutures to the skin. He cannot often, however, succeed in doing this, the bowel being rarely found at a less distance than an inch from the perinæum; but when he can, the advantages are great. Where this cannot be done, repeated dilatation of the perforated bowel is absolutely essential to maintain its patency, for otherwise, like all artificial openings, its subsequent contraction will take place. The introduction of a finger once or twice a week is sometimes enough for this purpose, and in a case I have under care, where the tendency to contract rapidly is marked, the introduction of a large sea-tangle tent has answered admirably, the tent being placed in water for a few minutes before it is introduced, to make it swell.

When the anus opens in an abnormal position, as in the vagina, and the anus made by the surgeon is established, there is a natural tendency for the abnormal opening to close, several cases being on record in which this result ensued. One has occurred in my own practice, and in a second the same result has been nearly completed.

When the exploratory ano-perinæal operation has failed to give relief, or when it is inexpedient to make the attempt from the very backward position of the genital organ, other measures must be adopted, and of these the opening of the large intestine through the abdominal walls is certainly the best. M. Rochard, in the "Mémoires de l'Académie Impériale de Médecine," 1859, gives ten authentic successful cases of Littre's operation in the groin for this affection; but Guersant opened the colon in the groin eleven times in succession, and once in the loin, without saving one patient. Holmes tells us, in his admirable work, "On the Surgical Diseases of Children," that he had not met with the account of any permanently successful operation since the publication of Rochard's paper. Giraldès had, however, one case in which a child lived two months and a half, and died of another cause.

The operation, however, to be successful must be undertaken early, before the infant is exhausted, and peritonitis has set in. Delay is only justifiable when the bowel is not distended, and the symptoms are not in any way urgent.

With respect to the form of operation, that known as Littre's is probably the best, by opening the bowel in the groin; the left groin is the one usually selected, although the right one has been recommended by Huguier, on account of the absence of the rectum in these cases, and the frequent bend in the colon towards the right groin. Giraldès has, however, shown from dissection, that in thirty infants operated on for imperforation, the intestine was found on the left in all. ("Nouveau Dict. de Méd. et de Chirurg. pratiques," 1864.) I have on two occasions performed Huguier's operation with temporary success. This question is, therefore, still *sub judice*. Amussat's operation in the loin is rightly put aside in these cases on account of the natural looseness of the colon at this part in children, and the very usual oblique turn of the colon after its splenic flexure. Figures likewise help towards the same conclusion, for out of fourteen instances in which Littre's operation was performed, nine recovered, whereas only two out of seven recovered after the lumbar operation.

The operation itself will be described in a future page.

In the treatment of the third class of cases, where the rectum opens into the vagina, the surgeon may lay open the rectum from the position of the natural anus into the vagina, having previously passed a director into the vaginal orifice of the gut as a guide, drawing down, when possible, the bowel, and fastening it to the integument by sutures, as originally performed with success by Amussat; or he may perform an operation in the

region of the anus similar to that which has been described in cases where no vaginal orifice existed, and this operation is the better of the two. As a guide to the perineal incision, the surgeon may pass a bent probe into the vaginal orifice of the bowel, and turn the end towards the perinæum, cutting down carefully upon it. I have done this with success in four cases, and in all stitched the bowel to the margin of the integument, forming a good anus. In one case the vaginal orifice subsequently closed. In two of the cases that were operated on several years ago, the patients have good control over their motions, and the vaginal fecal fistula seems to be contracting, liquid motions alone passing. The third case is an infant now under care, doing well.

In exceptional instances the deformity seems to cause no inconvenience. Ricord has recorded one ("Gaz. des. Hôp.," 1833) in which the woman was married, and her husband was quite unconscious that anything abnormal about the parts existed. Le Fort has recorded a second, in which the woman was married, and had had three children, the malformation having been accidentally discovered by the doctor in an examination for some suspected disease of the bowel.

"In such cases as these," adds Holmes, "the termination of the rectum in the vagina must be tolerably free, and there must either be an external sphincter, or the internal sphincter must be hypertrophied."

When the *bowel empties itself into the bladder or urethra*, the case is a very hopeless one. An exploratory operation in the region of the anus may, however, be made with the usual caution, with the hope of reaching the intestine, and on its failure Littre's operation should be performed. When the rectum opens into the urethra, the prospects of a successful issue of the case are better than when it opens into the bladder. Mr. Curling has related one case in which permanent success followed treatment. The boy, when seen by Mr. Curling, was eight years old; he had a good anus in the groin, but still suffered from the occasional passage of feces into the urinary passages.

By way of summary the following conclusions may be given:

1. In all cases, with some rare exceptions, whether of imperforate anus, obstructed rectum, or misplaced anus, an exploratory operation in the normal anal position ought to be made, success following the attempt in nearly half such cases.

2. Such exploratory operations, however, to be successful, must be undertaken early, and conducted with great caution. The line of puncture or incision should be upwards and backwards towards the sacrum.

3. When these means fail, or are inapplicable, the intestine is to be opened in the groin, it being still an open question whether the right or left side should be selected; the latter is the usual one.

4. When an artificial anus has been made, its constant dilatation is a necessity.

For further information on this subject refer to Curling's paper, "Med.-Chir. Trans.," vol. xliii, and French Edition of Holmes's "Surgical Diseases of Children," by Dr. Larcher. Bodenhamer, Wm., "On Malformations." Wood, New York, 1860. Ashton, "On Rectum," 3d edit., 1860.

Injuries of the Rectum.—The anal orifice and lower part of the rectum may be wounded by accident from falls, or by design, and when this occurs hemorrhage is a common result. Repair, however, rapidly goes on in these regions, and with the arrest of bleeding by securing the divided artery, or pressure, and water-dressing, a good result may be anticipated.

In **parturition** the rectum is sometimes laid open by rupture, either alone or with the perinæum, and when this event occurs the rent ought to be brought together at once, for if this practice be not adopted a plastic operation will have to be performed subsequently.

In the *act of defecation* small lacerations of the anus are not uncommon when the motions are very large or hard; and H. Mayo ("Dis. of Rec.," 1833) relates the case of a lady who, during a violent effort at defecation, felt something give way, and on the following morning discovered fæces in her vagina. An examination revealed a rent two inches up the bowel, large enough to allow the end of the finger to pass from the rectum into the vagina. Cases are also on record when during parturition a child's head passed into the rectum, and was delivered per anum.

In the milder forms of laceration of this kind, cleanliness and laxatives are, as a rule, sufficient to allow the parts to heal. In some cases the rent passes on into what is known as the fissured anus or painful ulcer of the rectum, and must be dealt with accordingly.

Wounds of the rectum inflicted by the surgeon as a rule heal readily, as the cases of fistula in ano treated by operation, and the recto-vesical operation for stone, fairly prove. The puncture made in the operation of tapping the bladder as a rule also heals quickly.

It is well to remember that the rectum may be wounded by the passage of a bougie, enema syringe, or the introduction of an O'Beirne's tube. The Guy's Museum contains specimens illustrating all these forms of injury, and at St. Bartholomew's there is a specimen of perforation of the rectum by a metallic clyster pipe, through which gruel was injected into the peritoneal cavity.

Foreign Bodies in the Rectum.—These may be introduced from *without*, either from mischief or accident, and some trouble may be experienced in their removal, their shape and position influencing the result. More commonly, however, they have been swallowed, and have passed down the canal, becoming caught or impacted in the rectum. They are not infrequently the cause of anal abscess, bones, pins, bristles, &c., being constantly found in the rectum under these circumstances. Stones, hair, or husks may likewise form concretions that are foreign bodies. When large foreign bodies have been introduced into the rectum, or concretions or solid masses of fæces become impacted there, chloroform should be given to allow of their removal, care being taken not to injure the walls of the bowel more than can be helped. With the patient under the influence of chloroform, the sphincters become so relaxed as to allow of the introduction of large instruments, or even the introduction of the hand to guard the bowel and remove the foreign body. Bottles, pots, cups, corks, rings, pencil cases, bougies, sticks, &c., have been impacted in these regions, and considerable care is needed to remove them without causing injury. The injection of plenty of warm oil before the attempt greatly facilitates the operation. Lithotomy scoop or forceps are likewise valuable, but the ingenuity of the surgeon is called for in every case to find the best means to carry out the end in view.

A large collection of such cases, with their treatment, is given by M. Morand, in "Memoirs of the French Academy of Surgery," vol. iii; and by Ashton, in his work "On the Rectum."

The Diseases of the Anus or Rectum.—The diseases of the rectum and anus have only recently received sufficient attention from the great body of surgeons, and, as a consequence, they have been too often allowed to fall into the hands of "quacks;" and although able and respectable specialists have since rescued this important class of cases from their hands, much

remains to be done by the profession, as a whole, to bring the diseases of these parts into their right position into the hands of the general practicing body of the profession. Again, in no class of cases are so many mistakes met with as in this, and these mistakes almost always arise from a want of a proper local examination of the parts. The anus or rectum are either unlooked at or unexamined from some mistaken notions of delicacy, or are badly examined from want of knowledge or want of inclination. But such things should not be, and every patient who complains of anything like persistent symptoms in those regions should be as carefully examined as he or she would be were any other locality equally affected. To do this some nicety is required, and to help the student the following hints may be acceptable.

Examination of a Patient.—The best position is on the side, with the legs well drawn up, and thighs flexed upon the abdomen, the hips being brought well to the edge of the bed or couch, in a good light; with one hand, the surgeon having uncovered the parts sufficiently to expose them, may then raise the upper buttock, and in doing this the anus comes well into view; in operations this may be done by an assistant. When an abscess exists, it will then be seen; if a fistula be present, its external orifice will be apparent. Fissures, warts, condylomata, or fleshy, flattened, cutaneous vegetations, or cancerous tubercles, will also be at once recognized.

Pendulous loose folds of skin about the anus will suggest the former existence of external hæmorrhoids; blue turgid venous projections their present existence. A tightly contracted and rigidly drawn up anus, as a rule, means some painful ulcer of the part; and a patulous anus through which flatus or discharge passes, without the patient's wish, too often means extensive rectal ulceration or stricture.

Internal piles, when prolapsed, will appear as turgid, vascular, mucous projections, surrounded by everted integument more or less œdematous, and covered with mucus or blood; prolapsus recti, as a greater or less annular projection of smooth or rugous mucous membrane, with a central intestinal orifice. A polypus projecting will appear as a cherry, surrounded by healthy structures. All these points are taken in at a glance, and interpreted. A digital examination is then to be employed to confirm or refute the suggestions thus taken in by the eye. To do this well the index finger should be thoroughly well anointed with lard or ointment, it being a good plan previously to fill the nail with a piece of soap; it should then be applied to the anus, and the patient told to bear down, for in doing this the sphincter is relaxed. The surgeon may then with ease, and without pain, introduce his finger. When an ulcer exists at the anus pain will be felt, and spasmodic resistance to the introduction of the finger, and with the pulp of the finger slowly moved round the anus, the ulcer will probably be felt; it should be stated, however, that in many cases this ulcer will be seen by a careful drawing down of the skin of the anus till the margin of the mucous membrane becomes visible. A spongy, nodular feel of the mucous membrane, just within the sphincter, will suggest internal hæmorrhoids; a local, tender, and raw surface, the probability of a simple ulcer; a circular, indurated raw surface, that of a syphilitic sore; while a cancerous ulcer is known by an infiltrated, nodular, and thickened surface. A stricture within two inches of the anus can always be detected by its annular form, or the obstruction which it causes. When a healthy piece of bowel separates the anus from the stricture or ulceration, the probability of the disease being cancerous is rendered great. When no such healthy tissue exists, syphilitic disease is rendered probable. A digital examination will always detect

the presence of scybalæ or impacted fæces, and also the encroachment of uterine or pelvic tumors in women, and prostatic tumors in men.

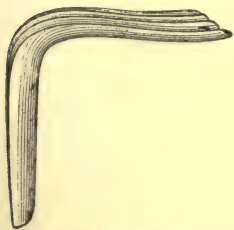
To confirm these opinions thus formed, a speculum may be used; and this should be introduced well warmed and greased in the same way as the finger.

Mr. Allingham "advises the prone position, with the hips well elevated upon hard pillows, to such an inclination that the intestines will gravitate towards the diaphragm, so that when expiration takes place the rectum becomes patulous, and you can see as far as the sigmoid flexure perfectly distinctly." This mode of examination he tells us was suggested to him by Dr. Marion Sims ("On Diseases of the Rectum," 1871).

The speculum represented in Fig. 183, as made for me by Krohne, is the one I like best. With these brief general remarks we must pass on to the special affections.

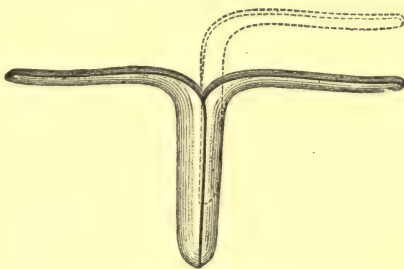
Fissure and Painful Ulcer of the Anus is a most distressing affection; it produces more misery than any other local disease with which I am acquainted; it renders the natural act of defecation an agonizing one, often "causing great drops of perspiration to course down the temples." It is usually caused by a mere mechanical splitting of the orifice of the anus, at the junction of the mucous membrane of the bowel with the skin, from the passage of a large or indurated motion, although it is not always traceable to such a cause; in some instances it seems to owe its origin to scratching

FIG. 183.



A nest of three.

FIG. 184.



Two adapted for use.

the parts when highly irritable, or to want of cleanliness. It is a disease of adult life, and is common to both sexes. It generatly manifests its presence by some local uneasiness in the act of defecation, this uneasiness passing on to pain more or less severe. This pain, as a rule, is experienced during the passage of the motion, but in some instances it comes on after the lapse of time, varying from a few minutes to even an hour or more after the act. The pain may last a few minutes or hours, and when it passes away the patient is easy till the same cause excites the same symptoms.

If the motions be examined when an ulcer exists, they will often be streaked with a line of pus or blood, and the size of the motion will always be diminished, sometimes being flattened, at others pipe-like, and this diminution in size is produced by the spasm of the sphincter.

On examining the anus under these circumstances, the first thing that will strike the observant surgeon is the unnatural resistance the patient makes on separating the buttocks; and on doing this the powerful contraction of the sphincter that will be visible. On attempting to introduce the finger, much resistance will be met with, and should the surgeon persevere in his attempt, the greatest pain will be caused.

The symptoms of the affection and local signs already given are, however, as a rule ample to excite in the surgeon's mind a suspicion as to the nature of the case, and render it unnecessary to make a digital *internal* examination, until he is prepared surgically to treat the case.

Indeed, a careful *external* examination will often reveal the presence of an ulcer on the verge of or within the sphincter; when within, its outer border will be visible. The ulcer is usually placed at the posterior margin of the anus, but not invariably; it is rarely larger than a sixpence, seldom so large; when recent, it will be soft, with slightly elevated edges, when of long standing, indurated with an irregular surface, small polypoid growths fringing its border. The ulcers are at times multiple, in exceptional cases involving the bowel higher up. It is an affection of the mucous and sub-mucous tissue; it is painful only from its position, and obstinate in healing from its connection with the sphincter ani. Simple fissures of the anus rarely involve other than the mucous membrane and skin around the parts; they are often associated with piles, and occasionally with small polypi. Ulcers are often hidden from view when piles or folds of skin about the anus exist, but pain indicates their presence.

This disease is a local one, and is found as often in the healthy as in the feeble subject, but it soon tells upon the strongest patient where it has been allowed to go on uncontrolled. Constipation, high feeding, sedentary habits, and want of local cleanliness, are the common causes. Anything that sets up irritation in the intestines is likely to produce it, and when once started, unless treated with discrimination, it may go on for years. It is by no means unusual to hear that the symptoms have been endured for two, four, or even six years.

In women it is so often associated with reflected uterine symptoms, that it is overlooked, and in men urinary irritation may mask the disease. Reflected nerve pains down the leg, as in sciatica, or in the loins, as in lumbago, &c., are often induced by the affection.

TREATMENT.—Happily for our patients, the treatment of this disease is as successful as it is simple. *Simple fissures* are readily treated by the administration of a laxative, the local application of the nitrate of silver, or of lead lotion mixed with the extract of opium, and local cleanliness, simple nutritious but unstimulating diet being given. At times, when the parts are indolent or syphilis is suspected, black wash is a useful application, or calomel dusted over the part, or in an ointment, five grains to a drachm of lard, or the application of mercurial ointment with the extract of belladonna. Injections of the decoction of rhatany are sometimes of great use.

When a larger *ulcer exists*, and is the cause of spasm and pain, and is quite recent, the same treatment may be employed; but it is quite exceptional for a cure to take place by these means when the ulcer has existed for any time and has a hard base; indeed, the surgeon is hardly justified in making the attempt when he has at hand such an efficient means as the *division of the base of the ulcer with the superficial fibres of the external sphincter*. In many cases this can readily be done by the introduction of the finger with a probe-pointed bistoury pressed flat upon it till the point reaches the upper margin of the ulcer, when the edge may be turned towards its surface, and its base divided. Boyer, who first suggested the principle of treatment, advised the free division of the sphincter, but Copland and Brodie introduced the minor operation, and it is in the bulk of cases sufficient to effect a cure. In exceptional instances Boyer's operation may be demanded. When chloroform is given, a speculum may be used, and the ulcer exposed. Under such circumstances a sharp bistoury may be passed beneath the base of the ulcer, transfixing the tissues and cutting inwards;

Syme advocated this method. The essential point of practice to observe is the free division of the base of the ulcer down to healthy tissue; the mode of doing it is unimportant. When any fold of skin or pile exists near the ulcer, it should be removed. The *forcible dilatation* of the sphincter, and its laceration with the thumbs in the rectum, which is practiced abroad, is a barbarous treatment compared with the above. W. Van Buren, of New York, however, advocates it.

Division of the sphincter as a rule gives immediate relief. In the after-treatment the bowels must be kept slightly loose, and for this purpose nothing equals in value a mixture of one ounce of olive oil, rubbed down with forty-five grains of carbonate of potash, and mixed with seven ounces of peppermint-water, one ounce being given two or three times a day to produce a soft evacuation; some spirits of chloroform may be added when necessary. Indeed, before the operation as well as after, this mixture should be employed; when this fails, enemata ought to be used. The diet should be simple, and rest observed till the cure is complete, for where this rule has not been observed, I have known the ulcer become so indolent as to require a second division, which under other circumstances is rarely called for. Tonics are often of value during the convalescing period.

Spasm of the Sphincter is only a symptom, it is not a disease; it is due to reflected irritation from some local rectal, uterine, or other affection. It may be some small or superficial ulcer beyond the verge of the anus, the presence of worms, or other cause of irritation of the mucous membrane lining the bowel, or the existence of a small polypus, but a cause will be found by careful investigation.

The same remarks are likewise applicable to *neuralgia of the rectum*, although it is quite reasonable to believe that a pure neuralgia of this part may occur as of any other. Still, as a rule, it is caused by reflected irritation from some nerve with which the part is connected, and the surgeon should clinically so regard it. It is said to be common in gouty subjects, and it is certainly relieved by free purgation.

Dr. Ringer, an able surgeon in the Indian army, has related to me several cases of this complaint clearly caused by malaria, and cured by large doses of quinine.

Anal Abscess and Fistula in Ano.—The two subjects of anal abscess and fistula in ano are classed together, as the latter disease is almost always preceded by the former, although it is equally true that a large number of cases of anal abscess get well without passing into a fistula. Out of my notes of 236 consecutive cases of the two diseases, 43 commenced and ended as anal abscess, the remaining 193 being treated as fistula in ano; 74 of these cases were in females, and 162 in males, men being evidently more liable to this affection than women. I have treated a case in a male child four months old, and a second in one fifteen months; in the latter the fetor of the discharge was very great; both recovered.

Of the causes of this disease little positive information can be given. The abscess, in the majority of cases, begins without any evident cause, and careful questioning generally fails in obtaining definite information upon the point. As a rule, the abscess is obscure in its origin and slow in its progress as in its repair; some patients even profess to have been quite unconscious of its existence till it was about to burst. In other cases they are very *acute* in their action, and very painful.

That a fistula in ano, and consequently an abscess, must always depend upon and be the result of an ulceration of the bowel within the sphincter is an opinion which can hardly be regarded as true. The fact that there is no evidence to support such an opinion, and that so many instances as forty-

three out of the cases quoted of anal abscess should have recovered without forming a fistula, tend much to prove its error; for it can hardly be believed that an anal abscess, the result of a perforated bowel, should recover as soon as an external outlet has been obtained; it is not unfair to infer, therefore, that in many cases it depends upon a different cause.

In fistula in ano this argument must be equally strong, for it is generally believed that this affection is merely the sequel of the anal abscess; we must therefore look for some other and more general cause than the one ordinarily received, namely, perforation of the bowel from ulceration.

The mechanical irritation of a foreign body is doubtless an occasional cause, it being by no means uncommon for a surgeon to remove from the anus, when opening an abscess, a piece of fish-bone, bristle, or other foreign body. Not long ago I removed a pin.

These affections may occur at any period of life. I have seen a fistula in a child six months old, and have heard of a case that was congenital, the mother having conceived when worrying about her husband, who was suffering from fistula. The case occurred in the practice of Dr. Lipscomb, of St. Albans, who related it to me. In the majority of instances, however, it occurs in adults between twenty and forty years of age. It is very common to be told that the fistula had existed for several years before surgical aid was sought.

With respect to the connection between phthisis and fistula it is difficult to give any positive information. When registrar at Guy's many years ago, I inquired carefully into this point in every case, but I had only 3 cases out of 193 in which either hæmoptysis had been present, or any other symptom of marked phthisis. In the majority of cases the patients presented no more severe cachectic symptoms than exist in any other class of hospital patients, and I confess to being somewhat doubtful as to the fact that fistula in ano is a common consequence of phthisical disease. When associated with it, unless the chest symptoms are very severe, the fistula should be treated in the usual way.

When a fistula has two openings, one externally and the other into the bowel, it is called *complete*. When there is an external but no internal opening to be found, it is known as the *blind external*. When an internal but no external, *blind internal*.

That an internal opening as a rule exists is now scarcely doubted, although at times there may be great difficulty in finding it. M. Ribes in 1819 examined the bodies of seventy-five people who died with fistula, and in all he found an internal opening; in nearly all, this was placed just within the sphincter, but in no instance was it higher than half an inch. Modern surgeons now accept these facts. The pus that forms in these parts is at times very offensive, as often from the mixture of feculent matter as from the absorption of fetid gases through the mucous membrane. In a large number of cases the discharge has no fecal odor.

It should always be remembered that an anal fistula may accompany severe rectal disease, such as stricture or ulceration, or that it may be connected with disease of the pelvic bones, &c. In a case seen recently, an enormous abscess existed at the base of the bladder, between it and the rectum; it was in an old man. Constitutional symptoms were very severe till two deep incisions were made on either side of the perinæum, giving exit to a quantity of pus; a good recovery ensued. It this instance it was a question whether the prostate gland was in fault, but no symptoms of such a complication could be made out.

TREATMENT.—In cases of anal abscess a *free incision* is the best practice, and this should be made as soon as fluctuation can be felt externally, or

through the bowel. Deepseated abscesses in these regions should not be left to natural processes to open. When the abscess is in front of the anus and rectum, an early opening may be called for, on account of the retention of urine, to which it may give rise. The incision should be made from without inwards, in a line radiating toward the anus. In deepseated abscesses one or two fingers may be inserted well into the rectum, and the abscess pressed forwards before the incision is made, a sharp, straight bistoury being the best instrument to use; a piece of oiled lint should be inserted into the wound, and kept there for a day.

In a case I saw, a few months ago, owing to the neglect of making an early opening, emphysema and phlegmonous inflammation of the perinæum, scrotum, penis, abdomen, even up to the axilla, took place, a free communication evidently existing between the bowel and the abscess. The patient died from the constitutional irritation of the disease. The sloughing of the cellular tissue was very extensive and the fetor of the sloughs something to remember.

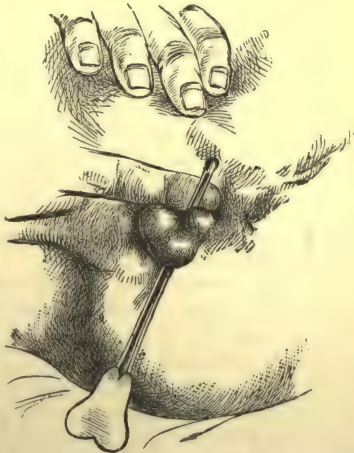
After the abscess has been opened, the patient must be kept at rest in the horizontal posture; water-dressing applied to the wound, and the most perfect cleanliness observed, laxatives being given when the motions are hard, and also tonics.

When a *fistula exists*, the best operation is its division into the bowel, the action of the sphincter ani having, doubtless, a powerful influence in retarding repair. The bowels should be previously cleared by a mild purge two days before the operation, and an enema may be given on the morning of its performance. The patient should be placed with the fistula upon the side upon which he is lying, with the legs well drawn up, and brought to the edge of the bed or couch, this position being better than that on the elbows and knees, or the stooping over a chair. An assistant should separate the buttocks. The surgeon should then introduce a fine probe-pointed grooved director into one of the fistulous openings, and with the greatest gentleness guide it through the fistula. Anything like force will excite resistance on the part of the sphincter to its introduction, and cause pain. Should the end of the probe pass into the bowel through the internal opening, all that is wanted has been effected. Should difficulty be experienced in doing this, the well-greased index finger of the opposite hand is to be carefully inserted into the rectum, and the internal opening felt for; when found, the end of the probe can readily be guided through it into the bowel. When no internal opening exists (a rare condition), the director must be forced through the bowel at the upper part of the sinus.

As soon as the director is felt in the rectum, the patient should be told to strain, the surgeon, at the same time, hooking with his index finger its end downwards. By these means, it will be made to protrude from the anus, and the whole of the tissues bridged over the director can be readily divided (Fig. 185).

When the fistula runs high up, and when much force is called for to turn the probe out of the anus, it is a better practice to pass a speculum and divide the fistula.

FIG. 185.



When a long sinus runs up the bowel, it should be laid open through a speculum—to leave it alone is not a safe practice—for, although in some cases a cure may take place, in many the discharge will continue into the rectum, and but little good will have been effected by the external operation. The presence of this internal discharging fistula is generally indicated by the appearance of pus upon the motion.

When many sinuses exist, they should be laid open, although it is not necessary to divide the sphincter in more than one place. A double division of the sphincter is apt to be followed by incontinence.

After the operation the wound should be well plugged with cotton-wool down to the bottom; no careless introduction of the plug into the bowel will suffice. By this measure all bleeding will be controlled, and any amount of pressure may be applied by means of a **T** bandage.

When no bleeding exists, only a moderate size plug is needed.

The second day the dressing may be removed, there being no necessity to introduce a second plug. A piece of oiled wool or lint gently introduced to absorb discharge is all that is required. The wound should be kept clean. When indolent, it may be stimulated by some lotion of nitric or carbolic acid, or tincture of iodine; tonics and good diet are also of value. The horizontal position must, however, be maintained till the parts have healed, not in bed, but upon a sofa.

In the *blind* internal fistula, a guide to the external wound may often be found by means of a bent probe hooked through the internal opening, and the case treated as any other.

When severe bleeding complicates the case, a speculum may be passed, and the vessel seized and twisted. Where this cannot be done, the rectum may be well plugged with a sponge saturated in alum; but, as a rule, a well-applied pad and pressure, adjusted with a **T** bandage, are sufficient to control it.

A piece of ice put into the centre of a cup-sponge, and applied to the anus, not only arrests bleeding, but gives great comfort in this as in almost all anal operations.

When a cutting operation is inexpedient, as in "bleeders," or the patient will not submit to it, the division of the fistula with a metallic wire, heated by the galvanic cautery, is a faultless method. Indeed, in all cases of fistula, where the apparatus can be obtained, a similar practice is the best. By it the tissues are divided readily, the two ends of the wire being made to project through the two orifices of the fistula, and burn their way out with a sawing movement, there is little pain at the time, and scarcely any after. There is no loss of blood, and, what is more, no need of any subsequent dressing, for a cauterized surface must heal by granulation.

When this plan cannot be followed, the treatment by ligature has been adopted. Mr. Luke revived the practice in 1845, but it has now fairly fallen into desuetude. Were I called upon to adopt the practice, I should use an india-rubber ligature.

In rare cases, fistula may be treated by injection, a daily injection of the sinus with some tincture of iodine, sulphate of zinc, or nitrate of silver, having been followed by a cure; but such cases are too exceptional to base a general practice on them.

When the patient's condition is such as to forbid any hope of repair in the wound taking place, the operation for fistula should be thrown aside; but the existence of pulmonary mischief, if not far advanced, is no argument against its adoption; nay, it may be made use of as an argument in favor of surgical interference, recent investigations, as already alluded to in an early chapter, having indicated that the long existence of suppuration

is liable to set up tuberculous disease. Practically, however, it is doubtless true, that fistula may be divided and heal in far from healthy subjects, and that the general health improves after the operation.

Hæmorrhoids or Piles.—In a clinical point of view, these may be divided into the “*bleeding*” and the “*non-bleeding*.” The *former* are generally the *internal*, and pathologically are composed of a highly vascular tissue, involving the mucous membrane of the rectum, and the submucous tissue, with enlarged arteries and veins. Where the arterial element predominates, the tumor has a bright red strawberry aspect, where the venous, a dusky hue; they are closely allied to nævoid structure, and discharge arterial blood.

The *non-bleeding* or *external* piles are made up of the loose folds of skin that surround the anus; or a varicose, inflamed, or ruptured vein. When inflamed, these folds become œdematous and infiltrated with organized inflammatory products, and appear as fleshy growths of various degrees of density. The venous hemorrhoids also become swollen, and appear as bluish, tense, and painful tumors. When in an active state, they may encroach upon the mucous membrane of the rectum, and appear as large as a walnut, but, as a rule, they are about the size of a nut. They rarely give rise to much annoyance when cleanliness is observed; but, under other circumstances, they cause much local irritation. When swollen or inflamed, however, they give great distress, from the sensitive condition of the skin at these parts. External piles are, however, occasionally the cause of hemorrhage, the blood at times coming direct from an ulcerated vein, the blood being then venous. At other times it will be profuse, but its exact seat is not so evident. The flow comes from between the pendulous flaps of skin, and ceases when they have been removed.

The TREATMENT of these external piles is simple, and excision is the only radical cure. The pendulous flaps of skin that surround the anus may be removed with a pair of sharp scissors, the tumor having been drawn forwards with a pair of forceps. The incisions should be made in lines radiating towards the anus. When coagulated blood has been poured out into the pile, and a tense painful tumor exists, it may be punctured or laid open with a lancet, bleeding, when it occurs, being easily arrested by cold and moderate pressure. When the pile is inflamed, leeching often gives comfort, and the application of a poultice, covered with the extract of opium, gives relief. When the part suppurates, the abscess may be opened.

In the early stage of the affection, local cleanliness, the abstinence from highly seasoned food and strong wines, are mostly sufficient, the bowels being kept clear by enemata, or the occasional dose of a mild aperient, such as the compound rhubarb pill before dinner, some saline purgative water or electuary. When local irritation exists, an ointment composed of equal parts of the zinc, nitrate of mercury, and subacetate of lead, is very valuable. Some surgeons recommend the compound gall ointment. An ointment of zinc and the extract of belladonna is very useful.

Internal Piles are very insidious in their growth; so insidious, indeed, that bleeding is often the first symptom that attracts notice. On inquiry, however, it may generally be made out that constipation has been the normal condition, and that irritation about the anus had previously existed, with a feeling of heat and fulness in the parts. They often appear after parturition. When the parts *inflamm* there will be throbbing, and pain in defecation; when they *protrude*, there will be one, two, three, or more masses of thickened mucous membrane with nævoid structure, sometimes with a smooth and tense, at other times with a reticulated surface; some-

times there will be oozing of blood from the whole surface, or the blood may spirt from a distinct orifice, the blood being almost always red and arterial, and this mucous projection being surrounded by skin, more or less pendulous, cedematous, or infiltrated with inflammatory products.

When the parts are not inflamed, this hemorrhoidal mass may protrude only during defecation, and return naturally, or after a little pressure. When the disease has been of long duration, the pile may protrude on the slightest exertion, or even on the patient assuming the erect posture, or on coughing, the whole mucous membrane of the rectum often participating in the prolapse, and adding to the discomfort.

Mr. Henry Smith reminds us, that a row of piles may exist within the anus, and a second half an inch or more higher up; some preparations in the College of Surgeons indicate this condition, proving the necessity of a careful examination of the bowel in all cases before operating.

The *pain* attending the development of these piles varies vastly, small hemorrhoids often giving rise to severe local distress, when large ones cause but little. An inflamed pile is, however, always painful, and a prolapsed, strangulated, inflamed one, the most of all. Where pain is excessive, and more particularly after defecation, there is a strong probability that a *fissure* or *ulcer* complicates the case.

The amount of *hemorrhage* bears no proportion to the extent of the disease. In one of the worst cases of hemorrhage I ever saw, in which a lady was blanched and almost pulseless, the pile was not larger than half a nut; it was of the reticulated kind, and the blood jetted from a vessel as large as the radial. On the removal of the pile, a complete recovery ensued. On the other hand, it is remarkable to what an extent the local disease may develop in some cases without producing excessive bleeding.

The bleeding, as a rule, takes place after the action of the bowels, and covers the stool; occasionally it precedes it; but in many instances it is quite independent of all action, blood flowing on the patient assuming the erect posture, or at odd times without any such cause.

The amount of blood said to have been lost, under these circumstances, is somewhat remarkable, authors upon these subjects, relating the loss of "three chamberpotfuls," "eight or nine pounds," &c. Doubtless, in many of these cases, exaggeration is a common failing; still, all surgeons must, at times, be astonished at the loss of blood that takes place in these cases daily, sometimes for years, with but little apparent interference with the general health.

The discharge of a thick mucus from the anus is a frequent accompaniment of this affection, and of a muco-purulent secretion when *ulceration* complicates the case.

Urinary irritation, and at times *retention*, in both male and female subjects, often add to the distress, and in women *womb* complications.

Nerve pains passing upwards to the loins, hips, and round the sacrum, or even downwards to the heel and sole of the foot, are likewise met with, Brodie having given a case in which the heel pain was the most prominent feature.

What are called dyspeptic symptoms are almost always present, the assimilating organs with the nervous and circulatory likewise suffering.

This affection is usually met with after puberty. In early life men are probably more prone to it than women, but after forty-five both appear equally liable.

Constipation has probably an important influence in causing the disease, and certainly in increasing it, but sedentary occupations and high living appear to have a stronger effect. In the prosperous classes of society this

malady is said to be a common one, although in the poor, daily hospital experience does not help to confirm the notion that it is rare.

Whatever tends to retard the flow of blood from the hæmorrhoidal veins, —such as pregnancy, and abdominal tumors—aggravates the disease, and whatever tends to keep up irritation in the rectum, such as drastic purgatives, worms, and pungent food, acts in the same way.

A pile may be mistaken for a polypus, but the smooth, firm surface and pedunculated form of the latter will reveal its true nature; again a ring of piles might be confounded with prolapse of the rectum, but the uniform smooth and generally non-bleeding surface of the latter, with its broad attachments, ought to be enough to prevent the error.

External piles when ulcerated may, however, assume very much the aspect of venereal anal outgrowths, and can be made out only by the history of the case and other clinical symptoms. Finally, it must not be forgotten that hæmorrhoids may be merely a consequence of another disease, such as stricture of the rectum.

TREATMENT.—All piles do not require removal. In the early period of their growth they may be so successfully treated by what is called *palliative* treatment as to render more active measures unnecessary; and in the very cachectic and diseased it may not be expedient to do more than relieve; although it must be added that unless organic disease exists to threaten life, there are few general conditions of a patient that forbid the removal of a severe bleeding pile. Again, when piles occur in plethoric subjects who are, perhaps, what has been described as apoplectic or gouty, when an attack of piles is preceded by constitutional disturbance, and followed by its relief, the surgeon should be careful in checking suddenly the flow of blood, for such a measure is undoubtedly sometimes followed by alarming constitutional symptoms, but such cases are rare.

The *palliative* or *general* treatment of piles means attention to diet; the giving up of high living and the taking of simple nutritious food in moderation, beer and spirits in particular being avoided.

The bowels must be regulated by the *Mistura Olei* already given, castor oil, rhubarb, and magnesia, or saline medicine or water, such as the Vichy, Friedrichshall, or Pullna, and should these fail, by enemata (indeed, the daily enema of cold water is of great value), all violent purgation, more particularly by aloes and colocynth, is to be avoided. Some surgeons give copaiba, but its nauseous qualities forbid its general use. The confection of senna or sulphur are useful medicines, and that of black pepper (Ward's paste) has been always popular.

When the secretions of the liver and intestines are unhealthy, a little blue pill at bedtime, or gray powder and chalk are sometimes of use, some bicarbonate of potash in gentian or calumba assisting recovery.

Absolute local cleanliness should always be observed, and the recumbent position assumed after defecation, the prolapsed pile being always reduced at once by gentle pressure. By these different means an attack of piles may pass away never to return, or to do so after a long interval, and even in the worst cases relief may be given.

When the piles are inflamed the application of leeches occasionally give great relief, bleeding being encouraged by hot fomentations; such means are, however, rarely called for, the complete washing out of the lower bowel, rest, and fomentations being as a rule sufficient. In some cases the application of ice in a cup sponge gives more relief under these circumstances than anything else.

When the prolapsed internal piles are strangulated by the sphincter spasmodically contracting around the mass, sloughing of the whole may take

place; under these circumstances great pain is caused by the tension of the parts, and on one occasion I was tempted to cut off with scissors some of the projecting portions, and the relief was so marked that I would do it again under the same circumstances, but to adopt this practice with safety the pile must be in the condition that precedes its death. When this sloughing takes place a cure may follow. During the sloughing process a poultice is probably the best application.

The mucous discharge from the bowel in long-existing piles can only be met by enemata and the application of astringents, an ointment of tannic acid, ten grains to the ounce, of gall and opium, or of extract of rhatany, half a drachm to the ounce of lard or spermaceti, being good local applications. The occasional introduction of a suppository of tannic acid into the rectum is likewise a valuable expedient; an enema of alum or tannin, five grains to the ounce, may also be used. Allingham speaks highly of an ointment of the persulphate of iron, half a drachm to one drachm of the unguentum cetacei, or, as a lotion, twenty grains to one ounce.

Surgical Treatment.—All piles, external or internal, should be removed, unless the general condition of the patient forbids, when by their presence they not only give local annoyance, but by the hemorrhage they produce, upset the general health of the patient and induce weakness. To do this many means are at our disposal.

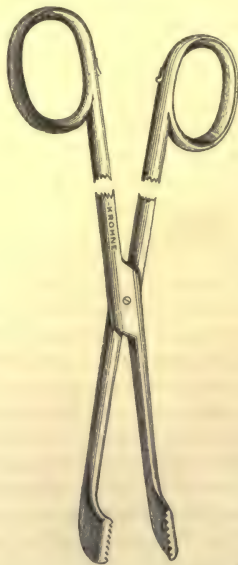
To deal with *external hemorrhoids*, as already stated, excision is the only method.

Internal piles ought never to be excised; they should be ligatured, or destroyed by the galvanic or actual cautery. In the hands of many surgeons the ligature still holds its ground, but with as many it has been nearly, if not altogether, set aside for the cautery; in limited cases nitric acid is of use. I have only used the ligature in exceptional cases for at least ten years.

FIG. 186.



FIG. 187.



The Ligature.—The hæmorrhoidal tumors having been made to protrude by the patient straining over a stool containing hot water, or by an enema

of warm water, and the parts well brought into view by an assistant separating the buttocks, the patient being on his side with his legs drawn up, the surgeon should grasp the base of the tumor that is to be ligatured by a pair of forceps such as that figured (Figs. 186-7), and separating the pile from the skin and submucous tissue by scissors, should transfix it with a needle armed with a double ligature either of silk or hempen cord. He should then divide the cord and tie the pile tightly in halves, cutting off with scissors half at least of the strangulated portion before finally tightening the second ligature; a second or third mass should be similarly treated, the whole is then returned within the sphincter, the ends of the ligatures having been cut off. The surgeon should be careful to include in his ligature all the diseased tissue, and when this has not been done with the forceps it is better to pass a needle or tenaculum through the base of the pile higher up, round which the ligature may be looped, than to remove the forceps and reapply it. He should also take care not to include any of the external skin. Mr. Salmon used to tie the pile as a whole, and not transfix it.

The ligatures may be expected to separate about the seventh or tenth day; they should always be allowed to slough off.

The bowels should be left undisturbed for at least two days, when a dose of castor oil or other purge may be given, or better an enema. After the operation an opiate may be given or a full dose of chloral (half a drachm); the horizontal position must be maintained throughout the case. Should œdema of the parts follow, ice may be applied, or a lotion of lead and opium, belladonna rubbed down with glycerin at times giving relief. Till the bowels act the diet should be simple, but nutritious, not stimulating. This operation is a successful one, and has no special danger. It is, perhaps, more tedious than the treatment by cautery, and more painful.

The Cautery.—When internal piles require removal the clamp and cautery are, without doubt, the best means to employ, and the *galvanic* cautery, when it can be obtained, is far preferable to the *actual*. Cusack, of Dublin, suggested this practice in 1835; but Henry Lee and Henry Smith have done more to establish it than any other surgeons. It is adopted as follows: The patient having been prepared as for the ligature, and the piles protruded, the different masses are to be separately seized with the vulsellum forceps, and drawn down. A clamp of any form that the surgeon fancies (Fig. 188, a modification of Curling's, being as good as any) being firmly fixed on its base, the upper end of the clamp presenting towards the anus, with the clamps firmly closed and held by an assistant, the projecting half of each mass is to be cut off with scissors, and the surface wiped dry. The galvanic cautery, heated to a white heat, is then to be applied to the surface, and the whole burned down to the level of the clamp, a dense eschar being thus formed. When the galvanic cautery cannot be had, the actual cautery iron is to be used, a second being at hand to use as the first cools.

The eschar is more solid and firm after the galvanic than after the actual cautery; it is likewise followed by less pain, the heat being so intense as to destroy all sensibility; a tolerable experience with both has convinced me of this fact.

The different masses having been destroyed, the clamps are to be care-

Fig. 188.



fully removed, care being taken not to disturb the eschars; with the finger well greased the whole projecting mass may then be returned into the rectum, it being a good plan at this moment to return with it a suppository of morphia to soothe the pain.

The patients should be kept at rest for at least a week after this operation, but they will often be anxious to get up much sooner, saying that they feel quite well; about a fortnight is the average time for convalescence, but a week in good cases seems enough. In one of the worst cases of internal piles I ever treated at Guy's I applied the clamp to four masses and burned them down as described with the galvanic cautery. After the first day all pain had gone; on the fourth the bowels acted naturally without the slightest inconvenience, and in a week the man was up, no single drawback having taken place. Such a case is, however, exceptionally good even for the cautery.

The after-treatment is the same as in ligature, the local application of ice, perhaps, giving greater comfort.

In some few examples of internal hæmorrhoids, where one or two sessile masses alone existed, I have, by means of a speculum, without the aid of a clamp, applied the galvanic cautery to their surfaces direct. Nothing but good results have followed this practice, and I am disposed to think in such cases it is the best to adopt. A good sound eschar forms at once, and on its removal a recovery takes place.

Demarquay ("Gaz. de Paris," 1860) merely passes a hot iron over the surface of the pile to produce a superficial eschar. He advises also linear écrasement where the piles only protrude on defecation and can be replaced, where the sphincter is not relaxed, nor the mucous membrane of the rectum prolapsed. In all other cases he prefers the cautery.

When nitric acid is used, the patient is prepared and treated in the same way as for the cautery, the nitric acid being applied with a piece of wood to the divided surface instead of the hot iron. The spoon-shaped clamp forceps are probably the best to use under these circumstances, the acid being less liable to run. The parts should be then well oiled and returned. This practice was suggested by Dr. Houston, of Dublin, fifteen years ago. To small, flat, strawberry-looking internal hæmorrhoids this plan of treatment is very applicable; it is, however, not so satisfactory as that by the galvanic cautery; I rarely now employ it. Ulcerating piles may be treated as others.

When a fissure or painful ulcer coexists with hæmorrhoids, its base should be divided before the operation for hæmorrhoids is undertaken.

In operating on internal piles the surgeon must be careful not to take the everted and possibly œdematous skin that encircles the mucous hæmorrhoidal mass for external piles, and remove it. It should on no account be touched. The pendulous external hæmorrhoids may, however, be taken away at the same time.

With respect to the use of chloroform in rectal operations some caution is necessary. When given the patient requires to be brought most completely under its influence, and in this condition the surgeon loses the valuable aid a patient can give in protruding the hæmorrhoidal mass, and consequently a greater dragging force is necessitated to bring the parts well into view. On the other hand, large operations are painful, and somewhat tedious. Upon the whole, probably it is advisable to use the drug.

Local anæsthesia in these operations is worse than a delusion, except for the removal of external piles. It is good also to assist their reduction when inflamed and œdematous; also to give relief after operation.

With respect to the danger of operating, it is but small; fatal cases have

followed both the ligature and cauter, and the advocates of the latter say it is safer than the former. Mr. Henry Smith, who has operated by the cauter in 200 cases, has had only two deaths. It has never fallen to my lot to lose a patient after the adoption of either practice, and upon the whole the operation for piles is a most satisfactory one, and contains no greater element of danger than any other.

Prolapsus Recti.—This is met with in every degree of severity, from the mere protrusion of a ring of *mucous membrane* through the anus (Fig. 189) to the prolapse of even a foot of *entire bowel*.

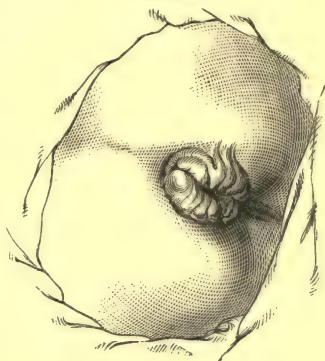
In children, a mild form of the malady is very common; but it is usually a symptom either of some urinary irritation, such as a stone, or that caused by a long or adherent prepuce; worms, constipation, dysentery, or any other rectal irritation, may likewise induce it, as may a cough in very feeble subjects, where the sphincter has lost its tone. One of the worst cases I have ever seen in an adult was due to the existence of a villous polypus high up the rectum; the straining accompanying the affection, and the hemorrhage were very severe, but a rapid recovery ensued on the removal of the growth. In another case, that of a lady, where the bowel had come down for sixteen

years, accompanied with daily hemorrhage, and in which walking was rendered impossible from the extent of prolapse—some six inches of bowel—the removal of the mucous membrane in three portions by clamp and cauter rapidly effected a cure.

To find out the true cause of the affection is, consequently, the first aim of the surgeon, the treatment being then comparatively simple. On the removal of the cause the prolapse rapidly disappears.

TREATMENT.—Whenever the bowel comes down, it should be returned, and this can usually be readily effected by placing the patient in the recumbent posture, and pressing with oiled fingers flat upon the part. In children the utmost gentleness should be employed, for with pain resistance is produced, and with it increased difficulty in reduction. Under all circumstances the patient should be kept in the recumbent posture. The bowels should be relieved in children lying down, and in adults the horizontal posture should always be assumed after natural relief. Brodie advised nocturnal relief of the bowels to be encouraged with this view. When the parts have been down for some time, the greatest trouble is often experienced in their reduction; indeed, sometimes it is impossible, although, with the patient under chloroform, success may attend the gentlest efforts when forcible attempts had previously failed. When the bowel has been reduced, a good pad, fastened on with a T bandage, will keep it in place, or the nates may be fastened together with some good bands of strapping. When the bowel is inflamed or ulcerated—conditions that soon occur in chronic cases when the patient goes about—some slight scarification may be called for; but the application of cold in the form of ice is probably the best treatment. In some obstinate cases in children the free application of the nitrate of silver in stick to the whole mucous surface, wiped previously with lint and mopped subsequently, is often followed by its reduction and retention. I have never seen this practice do harm; the application, at times, cures the disease. The injection of three or four ounces of water

FIG. 189.



made astringent with tannic acid, in the proportion of three grains to the ounce, or with tincture of iron, ten drops to the ounce, or of the infusion of krameria, or decoction of oak bark, with or without alum, after the bowels have been relieved, are valuable adjuncts; in adults the tannic acid suppository twice a day is useful, and also the application of the tannic acid glycerin before its reduction. A mixture of the solution of the perchloride of iron with two of glycerin is likewise a good application. Costiveness should never be allowed, enemata being used to keep the bowels empty, or the mildest laxatives, as rhubarb, castor oil, or some natural saline waters—as the Pullna or Friedrichshall. To give the bowel tone, tonics are, as a rule, required, nux vomica being probably the best drug, either alone or in combination with iron. In children, I have never employed this drug, but some surgeons speak highly of it, but the simpler tonics usually suffice. In children, as an alternative, the rhubarb, soda, and calumba mixture is to be recommended. In more severe cases of prolapse the application of nitric acid in vertical stripes is a very valuable treatment, or, what is better, the galvanic cautery similarly applied. In bad cases it may be necessary to remove three or four vertical folds of mucous membrane with the clamp and cautery, as if for piles. Copeland suggested the principle of practice, although he removed the mucous membrane by means of the ligature; Brodie improved upon it by adopting nitric acid; and modern surgeons have still further simplified the treatment by introducing the clamp and cautery, galvanic or actual. Few operations in surgery are more successful than this, and although in children it is probably never called for, in adults it should never be rejected, except for the same causes as operations for hæmorrhoids.

The treatment of such a case would be precisely similar to that laid down in the last section for piles.

Polypus of the Rectum.—This is not so rare a disease as authors would lead us to believe. In the adult it probably is a rare affection, but in the child it is the *principal cause of hemorrhage from the bowel*, and from this fact cases of polypus have been doubtless put down as cases of piles. These growths are generally found in children under ten years of age. In hospital practice they are mostly seen in the out-patient department. They appear to be more common in male than female subjects, for out of the last eighteen cases I have analyzed from my note-book, fourteen were males, thirteen were in children under ten, and five in adults. They vary in size from that of a pea to a large cherry. They grow from the submucous tissue, and are covered by the mucous membrane; when beyond the reach of the sphincter, and small, they probably do not cause any inconvenience; when large, they may give rise to straining of the bowel, and even intussusception. Mr. Pollock (*"Holmes's Syst.,"* vol. iv, ed. 2) has given such a case, and in another I have to relate the same result ensued. As they near the sphincter local irritation is produced and hemorrhage, the growth appearing often at the anus as a pink or red cherry. Blood sometimes flows from the anus only during defecation, at other times independently of it. When the polypus is low down there is usually with the blood a free discharge of mucus.

Whenever a child is brought with these symptoms a local examination should be made, and to do it efficiently the surgeon should sweep his finger completely round the walls of the bowel, having passed it well into the rectum. By doing this the polypus will be dragged from its attachment and its pedicle made tense. Sometimes several polypi exist together. I have on one occasion removed three.

They are made up of fibro-cellular tissue, being more or less fibrous

according to the age of the patient; in the adult the fibrous element predominates.

Whenever a polypus has been discovered, its removal is the only correct practice. In children, when I detect them with the finger, I generally manage to hook them down, and in doing so they often break off. I have never seen any bleeding follow this measure. On several occasions, when I have brought the growth external to the sphincter, the action of the muscle has broken it away, and in this manner many cases of polypi are naturally cured. When they do not break off, a ligature may be applied to the pedicle, but it is well to cut off the growth after its application beyond the knot. In adults the ligature should always be employed.

On the removal of the disease the symptoms disappear; should they continue, a second polypus will generally be found.

Villous growths are occasionally met with in the rectum, as in other parts of the large intestine, and when they are low down they give rise to violent straining and hemorrhage. This straining may, indeed, give rise to an intussusception of the bowel, and when of the sigmoid flexure to prolapsus recti. This was well exemplified in the case of a woman, æt. 43, whom I had under my care in June, 1867. She had suffered from prolapsus recti after every motion for twenty years, with more or less bleeding, the straining at times being most distressing. When I saw her the bowel was down for about nine inches; blood was then passing, and pain was great. I made a careful examination, but failed to find anything; I reduced the prolapsus, and prescribed rest. On my second visit, with the

bowel only down a very little, I examined her again and with my finger could just touch a new growth. With a pair of long forceps I took hold of it and brought it down, finding a splendid specimen of the villous polypus. I put a ligature round its base at once, and cut off the growth. No single unfavorable symptom had to be recorded subsequently; all her former troubles at once disappeared, and a complete recovery ensued. In June, 1870, this woman was still well. The growth is illustrated in Fig. 190, with the microscopical appearances (Fig. 191), and Dr. Moxon's report.

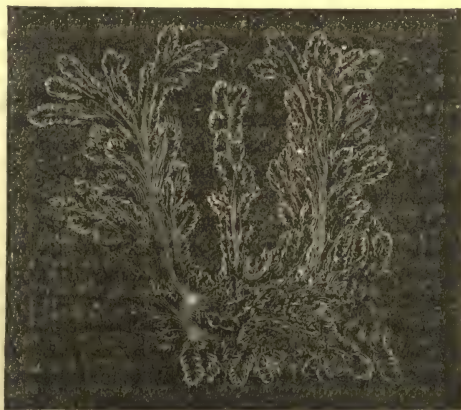
Condylomata are also very common about the

FIG. 190.



Polypus.

FIG 191.



Dr. Moxon's Report on Villous Growth, with drawings.

Vertical section of the growth through the line *a*, Fig. 190, showing vascular simple and compound villi, covered with a columnar epithelium; large vessels in the base of which the villi rest; and sections of the follicles of Lieberkühn. This section represents half the thickness of a lobule of the polypus seen by $1\frac{1}{2}$ -inch power.

anus; they are mostly syphilitic, but not always, the irritation of dirt being probably sufficient to produce them; in children they seem to come from the irritation of worms.

Cleanliness, the application of nitrate of silver, and the dusting of their surfaces with calomel or oxide of zinc, generally produce a rapid cure. *Vegetations* due to irritation of acrid discharges, such as *gonorrhœa* or *syphilis*, require to be excised.

Warty growths are also met with about the anus, as about other cutaneous surfaces. Sometimes they grow to a great extent, and then excision is the best practice. I have removed a mass the size of a fist.

Pruritus ani should generally be looked upon as a symptom of some rectal or intestinal irritation, constipation, or rectal disease. It is always a source of great distress, the most distressing cases being those that occur at night in bed, preventing sleep. The best application I know for its relief is a cold sponge, and, having dried the parts, the unguentum metallorum, made of equal parts of zinc, nitrate of mercury, and subacetate of lead ointments. Some surgeons recommend a lotion of the nitrate of silver, ten to fifteen grains to the ounce; the zinc and opium ointment is also good. These remedies, however, only relieve the symptom; for a cure, the cause must be found out and remedied.

Ulceration of the Rectum and Stricture.—The painful ulcer of the anus, or anal orifice of the rectum, has been already noticed, and it remains for us to consider briefly such other forms of ulceration of the rectum as are met with in practice. They may be described as *simple*, *syphilitic*, and *cancerous*. *Simple* ulceration is by no means infrequent, and when not involving the anus, it gives rise to symptoms which are usually looked upon as dysenteric. The passage of lumpy feces with blood and muco-purulent discharge are the chief symptoms. The sigmoid flexure and rectum rapidly passing on the intestinal contents as they descend gives rise to a slight griping pain, but beyond this there are few general symptoms. On examining a rectum, under these circumstances, a single ulcer will probably be found, but occasionally more. It may be somewhat indurated at its edges, but its base is not so as a whole. It is often circular, and at times surrounding half the rectum. In the case of a boy, æt. 16, that I lately treated, its surface was so nodular that I should have suspected its cancerous nature had I met with it in an adult; but in this instance it had existed for many months, and the granulations had evidently assumed a polypoid nature. It ended in a recovery. These simple ulcers are also prone to perforate the bladder, and induce recto-vesical fistula. I have had five such cases, and in four colotomy was performed with success, the operation taking away the chief source of distress—the passage of feces with the urine—prolonging life, and apparently allowing the ulcers to heal.—(*Vide* paper by author, "Clinical Soc.," 1872.)

These cases are to be *treated* by general means, such as a careful regulation of the diet, alkaline medicines with tonics, the administration of laxatives to render and maintain a soft condition of the feces, such as the *mistura olei*, and the daily administration of a small two-ounce enema of starch and opium, or simple oil, the recumbent position being maintained as much as possible.

Under these circumstances a good recovery generally takes place.

When these ulcers involve the anus, they give rise to the same painful symptoms as the painful ulcer of the anus, and must be treated in the same way by division of the superficial fibres of the sphincter.

Syphilitic Disease of the Rectum is a more common affection. It is met with in both sexes, but more frequently in women than in men, the disease

apparently creeping from the vagina to the rectum, although occasionally it is doubtless due to direct contact of the poison. It appears as a more or less extensive ulceration of the lower two inches of the rectum; it, as a rule, involves the anus, and may pass higher up the rectum. It is a disease of the mucous and submucous tissue, and is indicated in its early stage by a spongy induration of these tissues, and later by ulceration and the discharge of a highly irritating sero-purulent or sanguineous discharge, and a patulous anus. The anus itself may also be the seat of the lateral, flattened, fleshy, cutaneous outgrowth so common in syphilis, or it may be ulcerated likewise. It is generally a disease of young adult life, and is associated with some syphilitic history. There is almost always some pain in the act of defecation, some looseness of the bowels, and discharge of blood, pus, or mucus. In neglected cases, where cicatrization has gone on with spreading ulceration, there may be constipation and some stricture; indeed, as a cause of stricture of the rectum, this syphilitic disease is by no means unusual.

TREATMENT.—Recognizing its syphilitic origin, large doses of the iodide of potassium ought to be given, five grains three times a day, gradually increased to ten or twenty, in some bitter infusion or bark; when tonics are indicated they may be given in combination. The bowels should be kept slightly loose by the daily dose of olive oil or castor oil, so regulated as not to purge, and the daily employment of an enema of starch or gruel, with or without oil, to keep the parts clean and free from the irritation of feces.

The recumbent posture should likewise be observed, and simple, nutritious, but not bulky, food taken.

Locally, absolute cleanliness is essential; where contraction exists or is taking place, the daily introduction of a bougie anointed with some mild mercurial ointment, such as the unguentum metallorum, may be used; but for the patient, the daily introduction of a candle similarly anointed is far preferable, candles being made of all sizes. Nothing like mechanical dilatation should be thought of. By these means a cure may be effected, but it can only be after the treatment of months. In very neglected or severe cases a cure is almost hopeless without colotomy. The recognition of the disease as a syphilitic one is the main point to be made out.

Foreign authors describe *chaneroid* disease of the rectum, venereal but not syphilitic; in this country it is hardly recognized. Such cases may, however, be found amongst those described as cases of simple ulceration.

Cancerous Ulceration of the Rectum, usually **epithelial**, sometimes villous, rarely carcinomatous, is generally met with two or three inches up the bowel. It is occasionally seen higher up and beyond the reach of the finger, in the rectum, and occasionally lower down nearer the anus or involving it. It is remarkably insidious in its origin, and uncertain in its progress, giving rise at first only to such symptoms as are usually put down to constipation, for this symptom is the most prominent one, and the occasional pain and bearing down or straining are looked upon as the result of the constipation. In a general way, indeed, it is only when some blood or sero-purulent fluid has passed, with or without a motion, that surgical aid is sought, and it is under such circumstances that the surgeon discovers, on making a local examination, that such a serious disease exists.

The cancerous ulcer can rarely be overlooked; it occurs as an indurated, nodular, irregular mass; in its early stage with a smooth surface, in a later with ulceration, the discharge being made up of broken-up tissue, blood, and thin pus; it is generally very offensive. It, as a rule, involves the

whole circumference of the bowel, at times only a part. It is always associated with some narrowing of the canal, and this will go on to cause its complete occlusion. The symptoms, indeed, are those of stricture.

TREATMENT.—Palliative treatment can alone be thought of, such as the maintenance and improvement of the general health by diet and tonics, the removal of all local causes of irritation by the use of laxatives, to render the motions more liquid, and, consequently, more easy for evacuation, and the relief of pain by the use of enemata of starch and opium or morphia suppositories.

In the very early stage of the affection, before ulceration has taken place, the use of bougies may be justifiable and useful, but when ulceration exists they are worse than useless, they are injurious and dangerous. When the obstruction becomes a symptom of importance, surgical treatment will have to be thought of; this will be considered under the heading of stricture of the bowel.

Complications of Ulceration.—All cases of ulceration of the rectum may go on to cause stricture; the cancerous cases to a certainty will, the syphilitic often do, and the simple may when extensive. The two latter cause a *cicatricial* stricture, resulting from the contraction of the cicatricial tissue in the mucous and submucous tissue; the first produces a stricture by simple increment. They may likewise all be complicated with deep-seated abscesses and fistula, also with hæmorrhoids, thus the surgeon should always be careful when treating cases of these affections, to examine the rectum with care, for it is far too common to meet with cases that have been subjected to useless operations for piles and fistula, when these affections were the results of a far more serious disease, such as stricture, or ulceration of the rectum.

Again, any of these forms of ulceration may extend into the bladder or urethra. I have had four examples of such cases of vesico-intestinal fistula under my care in males, and one case in a female, in all of which the agonies of a foreign body in the bladder were added to those produced by the ulceration, and in the four male cases complete relief was afforded by colotomy. In three of these cases the ulceration seemed to be of the simple kind.

I have seen many cases of recto-vaginal fistula as a consequence of syphilitic and cancerous disease.

Stricture of the Rectum.—In the majority of cases this is caused by cancerous disease; in many it is the result of an inflammatory process, simple or syphilitic, from the cicatrization of deep-seated and extensive ulceration; in others, it is due to the contraction of inflammatory material poured out external to the bowel in the submucous tissue; in exceptional instances it may be caused by contraction of the parts external to the bowel after pelvic cellulitis, and Curling quotes a case where it was the direct result of an injury.

In all these conditions the calibre of the intestine is gradually or rapidly encroached upon, till at last complete obstruction takes place. The stricture may appear after death as an *annular* contraction of the bowel, with adventitious material in the submucous tissue and hypertrophy of the muscular coat, looking very like a so-called scirrhus pylorus, or as a thickened, ulcerated, irregular mass of cancerous material, infiltrating all the tissues of the bowel, although rarely extending beyond two or three inches in length. The bowel above the stricture will always be dilated, at times, even to its rupture, ulceration of the colon being a very common consequence of the dilatation. Below the stricture there will often be found

pedunculated, fleshy, or cancerous growths. These points are well seen in Fig. 192.

It has been already pointed out that fistula—ischio-rectal, vesical, or vaginal—abscesses and hæmorrhoids, are common accompaniments of stricture.

The disease, taken as a whole, is twice as common in women as in men, my notebook revealing the fact that thirty-two out of forty-eight consecutive cases were in this sex. But syphilitic stricture is more common in the female, and cancerous stricture in the male.

Curling, in quoting 67 cases of cancer, gives 44 in males; and in my 48 cases, 20 were found in subjects under thirty, 15 of these being women, and mostly, if not all, probably syphilitic; 22 were in subjects over forty, half being men, the majority of these being probably cancerous.

The approach of the disease is very insidious, whatever may be its origin or nature, and the symptoms are generally such as have been given under the heading of cancerous ulceration of the bowel.

Constipation is the one early symptom, and it is not till some ulceration has commenced, either at the stricture or above it, that others appear, such as *diarrhœa*, with lumpy stools, containing blood, pus, or mucus, *straining* at stool, and a *sensation of burning* in the part afterwards, with at last a complete stoppage, abdominal distension, and dyspeptic symptoms.

An examination with the finger carefully introduced into the rectum will, as a rule, at once reveal the true nature of the case, for about two inches up the bowel the narrowing will usually be felt, with or without new tissue infiltrating the part or ulceration. In exceptional cases the stricture is beyond the reach of the finger. Under these circumstances, however, it may at times be brought within reach by pressing with the free hand upon the abdomen above the pelvis.

When the stricture is an *annular* one, it is probably cicatricial, or fibrous, possibly cancerous.

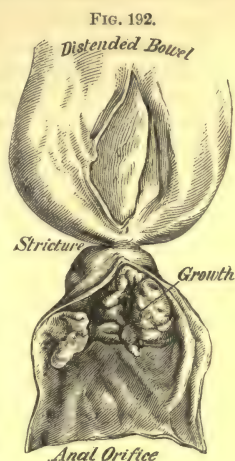
When *epithelial* or positively cancerous, the seat of stricture will be infiltrated with a nodular, irregular mass of new tissue, probably breaking down and ulcerating. Sometimes this mass can be felt externally at the brim of the pelvis over the left iliac fossa. I have felt this clearly on three occasions.

When *syphilitic*, the ulceration will probably extend upwards from the anus, and the anal integumental outgrowths, already mentioned, will probably exist.

In ordinary cases of cancerous stricture there is an inch of healthy rectum between the stricture and the anus; in exceptional and very extensive disease the anus is involved.

In advanced cases the anus will appear patulous, and on separating the buttocks a red, brickdust colored, feculent discharge may run out; wind will also pass without effort.

To flat, tape-like, or figured fæces, as given by authors as characteristic of this disease, I, with Curling, do not ascribe much importance, for such a condition of motion is very usual, even in a state of health, when the bowels are irritable, and many other conditions of the pelvic parts may give rise to the same thing; but when a patient never passes a well-formed motion,



323⁸⁰. Guy's Hosp. Mus.

large or small, the case looks suspicious. On the other hand, when a large well-formed stool is occasionally seen, the probabilities of a stricture existing are very slight.

The examination of a rectum, the subject of disease, with a tube, flexible or otherwise, requires the greatest care and gentleness. Fallacies may mislead the surgeon in every way, the end of the instrument striking against the sacrum, or being caught in a fold of mucous membrane, may lead him to suspect obstruction where none exists. But "if some warm fluid, as linseed tea, be injected somewhat forcibly through the tube, a space is formed admitting the easy transit of the instrument. In stricture pain is felt when an instrument reaches the point of contraction, and a flexible one is arrested or passed on with more or less difficulty." (Curling "On the Rectum," 1863.)

The surgeon must also remember, in examining a rectum for a supposed stricture, that its calibre may be more or less completely encroached upon by pelvic tumors, uterine, ovarian, prostatic, hydatid, or bony. Some few years ago I had a case with Dr. De'Ath, of Buckingham, in which an hydatid tumor caused complete obstruction to the rectum as well as to the bladder, and although the latter organ was emptied on the evacuation of the hydatid contents, the patient died unrelieved from an enormously over-distended and ruptured colon ("Trans. Path. Society," 1866), and in April, 1870, I saw, with Mr. Phillips, of Leinster Square, a most interesting case of complete obstruction of the bowels in a lady, *æt.* 46, caused by the presence of a large, loose, cancerous growth hanging into the pelvis from the peritoneum, covering in the promontory of the sacrum. The tumor had been regarded by an eminent physician accoucheur as uterine. Colotomy was performed with great relief, but death took place from collapse on the third day from a sudden rupture of the tumor and escape of its softened contents into the peritoneal cavity. In September, 1871, I attended, with Mr. Turner, of Bermondsey, a girl, *æt.* 18, who had had insuperable constipation for seven weeks. I opened her colon in the right loin with great relief, for she was up and about in six weeks, and still remains so. In her case, some fibrous growth is to be felt in the pelvis, completely obstructing the rectum. It has the feel of a large polypus.

TREATMENT.—It is so rare for a surgeon to be consulted about a stricture of the rectum till the ulcerative stage has set in, or nearly complete obstruction has taken place, that he has few opportunities of testing the value of dilatation of the stricture; for although this practice is clearly useless, if not injurious, when ulceration exists, it is probably of great value before any breach of surface has taken place. In cicatricial or inflammatory strictures, indeed, it is the only form of practice upon which reliance is to be placed, but in the cancerous, whether in the ulcerating style or not, it is not wise to make the attempt.

This dilatation is to be effected by mechanical means, and many instruments have been invented for the purpose. The elastic-gum bougie, in the hand of the surgeon, is, however, the best; forcible dilatation is inadmissible. They are made in many sizes, and the one chosen should be just large enough to pass through the stricture. It should be warmed and well greased, and guided by the finger passed gently through the stricture, and retained for ten or fifteen minutes at a time. When it does not produce any irritation, a second, larger, may be passed in two days; but when irritation is set up, the repetition of the operation should be postponed till it has subsided. By these means a simple stricture may be checked in its progress, and even dilated, but rarely cured; this practice may prolong life for years. Mr. Curling has, however, given a case in his book in which he believes he cured an annular stricture in a lady, *æt.* 24, by incisions and dilatation.

This dilatation is, however, only a means to an end, and that end is to secure an opening for the passage of the intestinal contents. Enemata are valuable aids to effect this purpose, the daily washing out of the bowel with gruel and oil giving great relief, or the daily dose of mist. olei with manna, confectio of senna with sulphur, or any other gentle laxative that by experience the patient has found to suit. Cod-liver oil in full doses often acts as a laxative, as well as a tonic. Care must, however, be observed in the introduction of the tube, for in a cancerous bowel perforation is very prone to occur, and even in a healthy one the same accident has taken place. The Guy's Museum contains a Prep. (1877⁶⁰), in which the colon was perforated by a bougie thirteen inches from the anus for an imaginary stricture; and a second (1877⁸⁰), in which an O'Beirne's tube perforated the rectum five inches from the anus, in an attempt to pass it up the healthy bowel to give relief in a case of obstruction after the reduction of a hernia.

How far it is safe to allow a patient to pass a bougie for himself or herself is another question. I am disposed to think it is an unwise act to allow when the bougie is solid, for I am sure I have seen great irritation, and, consequently, harm, follow upon the practice, and in several cases, deep-seated suppuration. Curling has given a case where the patient caused his own death by perforating the bowel half an inch in extent above the stricture. I have, consequently, been in the habit of instructing my patients to use candles as bougies, and have been well pleased with the practice.

There comes a time, however, when this treatment by dilatation ceases to be beneficial; when the stricture has so closed as to render it useless; or ulcerated so as to render it unwise to adopt the practice; or associated with so much distress as to forbid its use; and under these circumstances the operation of *colotomy* is of great value; it gives comfort to a degree that sometimes astonishes, and always gratifies. On convalescence or recovery it is not found to be practically associated with such inconveniences as surgeons of old have theoretically surrounded it. It prolongs life, and adds materially to its comfort, and little more than this can be said of most operations. But it must not be postponed till the powers of life have become so exhausted as to render the chances of recovery from the operation poor; or till the large intestine has become so distended as to have become damaged or inflamed. It should be undertaken as soon as it is clear that the local disease has passed beyond the power of local treatment with any prospects of good, and the general powers of the patient are *beginning* to fail; as soon as the local distress finds no relief from palliative measures, and a downward course with unmingled anguish is evidently approaching. The difficulties of colotomy are not great, nor are its dangers numerous; when *unsuccessful*, it has been usually made so from the delay in its performance; from the want of power in the patient; or death has resulted from the secondary effects of the disease on the abdominal viscera.

When *most successful* it gives immediate relief to most of the symptoms, and makes life worth having. When *least* so, by lessening pain, it renders what remains of life endurable. The operation is now regarded as established, and creditable to surgical art, according to Curling; but in the general way it has been postponed until too late a period to demonstrate its full value.

The Operation of Colotomy.—For irremediable stricture, or mechanical obstruction of the rectum from any cause, *Callisen's* operation of opening the colon in the *left* loin should always be followed; and when the seat of obstruction is higher than the rectum, and it is a point of doubt whether it be in the sigmoid flexure or transverse colon, *Amussat's* operation in the right loin should be performed; for Callisen first suggested colotomy in

1796, and applied it to the descending colon, and Amussat revived the operation, and extended it to the ascending colon in 1839.

The colon in this position lies behind the peritoneum, immediately beneath the transversalis fascia. The kidney is in close contact with it above, and in one case upon which I operated, the organ was placed so low down as to fill in the space between the rib and pelvis, and it had to be pushed upwards to allow the colon to be seen and opened. The operation is to be performed as follows, on the left loin :

The patient is to be placed upon his right side with a pillow beneath the loin, in order to arch somewhat the left flank, and turned two-thirds over on to his face; the outer border of the quadratus lumborum muscle is then to be made out, for this muscle is the surgeon's main guide. Its outer border with the descending colon is to be found half an inch posterior to the centre of the crest of the ilium, the centre being the point midway between the anterior superior and posterior superior spinous processes. Allingham says, that from more than fifty dissections, he has always found the descending colon to be so situated. He has never known this point to fail him; when difficulties are felt in the operation, he believes they are from the colon being looked for too far from the spine ("St. Thomas's Hosp. Reports," 1870). In this opinion I cordially agree. An incision is then to be made four or five inches long, beginning one inch and a half to the left of the spine, below the last rib, and passing downwards and forwards in front of the anterior spine of the crest of the ilium, with the line of the incision passing obliquely across the external border of the quadratus lumborum muscle about its centre, and taking the same direction as the nerves which traverse this part. By this incision the integuments and fascia are to be divided, exposing the outer border of the quadratus muscle; the abdominal muscles are then to be divided to give room, commencing at the outer edge of the quadratus. This had better be done upon a director. All vessels are now to be secured; the transversalis fascia will next come into view, and beneath this will be the colon, a layer of fat sometimes intervening; the fascia is to be opened with caution. In the loose fat and cellular tissue the colon is to be found, and when distended it comes at once under the eye on dividing the fascia; when empty, some little trouble may be experienced in hooking it up with the finger. I have found on several occasions great help by rolling the patient over on to his back at this stage of the proceeding; the bowel, falling into the finger, is then readily caught.

When the bowel has been caught it should be partially rolled forwards, in order to expose its posterior surface, for if this be not done there is a risk of the surgeon wounding the peritoneum, as it is reflected from its anterior surface on to the abdominal wall. The bowel having been drawn up to the wound, is then to be secured to the integument, not to the muscles, by the passage of two double ligatures introduced through the one margin of the wound, then through the bowel, and, lastly, through the other margin, these ligatures being firmly held by an assistant. The bowel may then be opened by a longitudinal incision about three-quarters of an inch long over the ligatures that have traversed its canal; the centre of the ligatures are then to be drawn out and divided into two portions; with these the two sides of the divided intestine are firmly fixed to the margins of the wound; two or four more stitches may then be introduced to make the artificial anus secure. The margins of the wound may be oiled to guard against the irritation of fæces, and the patient placed in bed. At times the fæces escape in large quantities directly the bowel is opened; at other times some slight feculent discharge will take place at the time, the larger flow taking place later. This is not, however, a point of any importance, and the surgeon

should take no measures to get the bowels to act; indeed, it is better, as far as the operation is concerned, that the flow be postponed, for within an hour or so the parts about the wound become sealed with lymph, and thus the risks of extravasation are diminished.

Amussat originally suggested the *transverse* incision in the loins, and Cal-lisen the *vertical*, the former one crossing at right angles the outer border of the quadratus lumborum muscle, the latter running parallel with it. The *oblique* appears to me to be far preferable to either; it gives more room for manipulation when the colon is empty, it takes the line of the nerves and vessels that traverse this part, and lessens the risk of their division. It follows the ordinary integumental fold of a patient when assuming the recumbent posture, and thus favors repair, and seems to tend much towards the prevention of the prolapse of the bowel that is always prone to follow such an operation. Fig. 193 illustrates the line of incision and the appear-

FIG. 193.



ance of the artificial anus. It was taken from a patient of Sir W. Gull's that I operated upon three years ago for vesico-intestinal fistula. The gentleman follows his avocation without any discomfort.

After the operation a good sedative should be given, such as opium, morphia, or chloral, and the recumbent position maintained, a piece of oiled lint covered with oakum, and kept in place with a soft towel, being the best application.

The sutures may be removed on the fourth or fifth day, according to circumstances, and the most perfect cleanliness must be observed.

Good food and stimulants may be given within a day or so of the operation, repair, as a rule, going on favorably.

When the wound has cicatrized, the patient may get up, and a folded napkin, fastened on with a lumbar binder, is a good application. The ivory ball or plug, that has been advised, appears to be a useless instrument; it cannot be kept in its place, and does not, therefore, prevent the prolapse of the bowel that is said to be so likely to follow the operation. An india-rubber ball, with enough of one of its sides taken away to cover in the wound, is an excellent instrument; it is capable of holding any little fæces or fluid that may pass; it retains wind and is a good pad. Three of my patients who are wearing it express themselves as feeling great comfort from its use.

With the oblique incision this prolapse does not appear to be the cause of any annoyance, for it seems to take place to a very slight extent. I have

five patients now living upon whom I have operated for artificial anus; in all the oblique incision was made, and there is no prolapse to trouble.

Should contraction of the orifice take place to too great an extent, a sponge tent may be daily introduced. Mr. Pollock gives a case where such treatment was a necessity. ("Holmes's Surg.," 2d ed., vol. iv.)

After convalescence it is well occasionally to wash out the lower portion of the bowel with warm water, for some faces are apt to pass the artificial opening and rest in the rectum, causing irritation. When the anal end is open it is best to do this through the natural opening, when it is closed, through the artificial one.

I have performed this operation now at least fifteen times: in four for vesico-intestinal fistula, in two for pelvic tumor, and in nine for stricture of the rectum. One of the cases of vesico-intestinal fistula lived four months after the operation, and died with suppurating kidneys, but entirely relieved from all vesical and rectal distress. ("Brit. and For. Rev.," Jan., 1869.) Two are now alive and enjoying life, suffering very little inconvenience indeed from the artificial anus. ("Clin. Soc.," 1872.) The patient with pelvic tumor, already noticed, died on the third day from rupture of the tumor. The second is in good health and comfort. Of the nine patients with stricture, cancerous and otherwise, one lived eighteen months after the operation in ease, dying from supposed cancer of the liver after a month's illness. Two lived two and four months respectively. One lived thirteen days, and two three days, the operation in all these having been undertaken at too late a period. One, however, died with peritonitis, and, I fancy, I may have punctured the peritoneum with the needle where it was reflected from the bowel. The fifth, sixth, and seventh patients are now alive, one having been operated upon in May, 1870; the second in November, 1871; the third in February, 1872.

Curling has performed or recommended the operation in seventeen cases, and in ten the patients survived over periods varying from two to eighteen months. Pollock gives a case where the patient has survived the operation for two and a half years. Allingham has had ten cases: one died within the fortnight of the operation, five lived a few months, one nineteen months, one four and a half years. Two are now living, three and four years after the operation.

These results cannot be regarded otherwise than with satisfaction, for it must be remembered that in all these cases the operation was undertaken when life was threatened, and the distress from the local disease was severe and otherwise irremediable. The operation is a good one in all cases of vesico-intestinal fistula, when solid feces flow with the urine; in all cases of stricture of the rectum, as soon as the obstruction becomes serious and local distress great; in all other cases of mechanical obstruction to the rectum from pelvic causes, when no less severe measures for relief can be suggested; and, last but not least, in extensive ulceration of the rectum, cancerous, syphilitic, or simple, when local treatment fails to give relief, and local distress is great, when the general powers are evidently giving way from the local disease, quite irrespective of all mechanical obstruction.

In no case, however, should the operation be postponed till the patient's powers are failing, for the prospects of recovery are greatly lessened, and convalescence is often rendered improbable.

Atony of the Colon and Dilatation of the Rectum.—These conditions are not rarely met with in practice. In old people, the colon, for want of power, often becomes enormously distended with feculent matter from gradual accumulation, and this condition is frequently the cause of death. In some cases it gives rise to the idea of stricture of the rectum, and every

surgeon must have been called to cases in which impacted *faeces* in the rectum and colon, associated with the discharge of small, loose, offensive motions mixed with mucus and sometimes blood, has misled the attendant. Some five years since I was asked to see a lady over seventy, who had been bedridden for six months, and was supposed to be dying from constipation and stricture of the rectum, nothing but small lumpy and loose motions having passed. No disease whatever existed beyond the impacted rectum and distended colon from atony of the bowel from old age. The masses were mechanically removed by means of the lithotomy scoop and enemata of oil, &c., and she lived four years, simply to die of old age.

In this form of constipation the value of *nux vomica* is well seen, a pill of half a grain of the extract with half a grain of belladonna, twice a week or oftener, giving tone to the intestine, and acting as a purge.

In women particularly, who have been in the habit of neglecting their bowels, and allowing the rectum to be a closed receptacle for feculent matter, the cavity not only becomes much distended, but seems to lose the power of contracting and expelling its contents. I had, at Guy's, five years ago, a case well illustrating these points; for the rectum felt, on examination, like a loose bag, it was large enough to admit a fist; it was always full, having evidently lost all power of expulsion. This woman had, in young life, neglected herself, and in middle age could not get over the effects of such neglect.

By daily enemata of cold water to wash out the bowel, and the subsequent injection of an astringent liquid, such as the decoction of bark and alum, with the daily use of a pill containing half a grain of extract of *nux vomica*, mixed with gentian, a complete recovery took place.

INJURIES AND DISEASES OF THE INTEGUMENTS, CELLULAR TISSUE, &c.

CHAPTER XXXVI.

CONTUSIONS, WOUNDS.

A "**contusion**" is caused by a blow from a blunt instrument, and is uncomplicated with any solution of continuity of the skin. When the blow has been sufficient to produce rupture of the small vessels in the skin and subcutaneous tissue, an "*ecchymosis*" or "*bruise*" is said to exist; when it so injures the deeper tissues as to cause effusion of blood from rupture of some of the larger vessels, "*extravasation of blood*" is said to be present.

Pain, swelling, and bruising are the three symptoms that consecutively follow a blow. In mild cases, however, the last need not necessarily follow.

An "**ecchymosis**" is an effusion of blood *into* the skin and subcutaneous tissue; it shows itself within a few minutes or hours of the injury, according to the force employed and depth of tissue injured, as a livid red, deep blue, or black patch, this patch in the course of twelve or eighteen hours becoming larger and lighter at its margins. About the third day it assumes a violet tint, on the fifth an olive-brown, on the sixth a green, on the seventh or eighth it has a yellow aspect, and this fading into a lemon tint then dis-

appears altogether. An ordinary bruise generally runs through all these stages in about two weeks, the rapidity of the process depending much upon the amount of blood effused and the reparative power of the patient. When no blood has been effused into the skin, but "extravasation" has taken place in the deeper parts beneath a dense fascia, the discoloration of the integuments may not appear for three or four days, and in some cases, where the blood has made its way between the tissues, and reached the skin away from the seat of injury, the "ecchymosis" will be at some distance from the spot at which the injury was received; when much effused blood exists the swelling will be great.

On making a section of a bruised part, the skin will be found throughout its thickness infiltrated with blood, and it will feel firmer and thicker than natural. These points are sufficient to indicate the fact that the bruise had been received during life, for a blow applied to a body after death will never cause such general effusion of blood into the cutis, nor such an increase of firmness in the skin. The effusion of blood that takes place will be in small quantities and venous, and beneath or upon, not in, the cutis.

Neither *purpuric patches* nor those of "*erythema nodosum*" ought to be mistaken for bruises. The general diffusion of the spots over the body in the one case, and the history and general aspect of the other affection, should prevent the error. It should be remembered, however, that in purpuric patients and in "bleeders" a slight blow or pinch may be followed by a severe bruise.

A slight contusion may only be followed by some local pain and swelling, this swelling becoming red, and then disappearing. The wheal that rises after a lash with a whip is the best illustration of this fact.

A severe contusion may cause a rupture of a large artery or vein, and thus cause a fatal extravasation; or it may so crush or pulp the tissues as to destroy their vitality; a spent cannon-ball does this. More frequently it causes a separation of the skin from the deep fascia and parts beneath, with more or less extravasation of blood into the split tissues. The effects of a contusion also vary according to locality; thus, over the scalp of an adult a local effusion of blood may follow a blow, and in a child this effusion may go on so as to form a swelling, involving more or less of the whole vertex. In the buttock and loins blood may be so effused as to give rise to a large fluctuating tumor. In the loose cellular tissue of the scrotum an effusion of blood may give rise to enormous enlargement, and in the eye every one is familiar with the change. Where the extravasation of blood has been extensive, the removal of the clot is a work of time. In some cases the blood remains fluid for a long period, at length becoming absorbed; in some it breaks down, and gives rise to suppuration. In exceptional instances it becomes apparently encysted, and "there is sufficient reason to believe," says Paget, "that blood extravasated in a contusion may be organized, acquiring the character of connective tissue, becoming vascular, and taking part in the repair of the injured tissues;" these changes are seen in the repair of fractures, and in ligatured or twisted vessels.

TREATMENT.—A slight bruise requires no treatment; if left alone it will get well. To check extravasation cold is the best application, in the form of pounded ice in a bag, or a mixture of salt and saltpetre, or the ice poultice;¹ this, with elevation of the part and rest, are the best means. Should

¹ Ice poultices, as suggested by Maisonneuve, appear excellent things for the local application of cold; they are made as follows: Take of linseed meal a sufficient quantity to form a layer from three-quarters to an inch thick, spread on a cloth of proper size; upon this at intervals of an inch or more, place lumps of ice of convenient size—of a big marble—then sprinkle them over lightly with the meal, cover

any disposition to inflame appear, some lead or spirit lotion may be used. To hasten the absorption of the effused blood, tonics are often of use, and the application of gentle pressure by means of bandages or strapping.

A lotion of the tincture of arnica, one ounce to a pint of water, seems to have some influence in hastening the absorption of blood, and Friar's balsam with carbolic acid is also of use. Some of the stimulating liniments, such as the soap or opium liniment, may likewise be employed.

In more severe and extensive effusion of blood, when the circulation in the part is interfered with, cotton, wool, or lint soaked in oil and covered with cotton-wool are the best dressings; warmth is thus maintained in the part; moist applications are not so good.

When the blood remains fluid, the surgeon must not be tempted to draw it off until all hope of its absorption has been abandoned. To meddle in these cases is often injurious; but when the blood has broken up and supuration has appeared, a free incision into the part, followed by the application of a poultice, is good practice, the cavity being kept clean by syringing with Condy's fluid or carbolic acid lotion.

When the fluid blood has to be evacuated, it should be by a free opening, unless it can be drawn off by the "aspirator," or exhausting syringe, by means of which the fluid is taken out, and no air let in.

Wounds.—When the soft parts of the body are divided by any mechanical force applied externally, they are said to be wounded; when the "solution of continuity" is produced by a sharp-edged instrument, the wound is called "*incised*;" when with a pointed one that stabs or pricks, "*punctured*;" when with a blunt instrument that tears, "*lacerated*;" when with any implement that bruises, "*contused*."

When the parts are only divided, the wound is called a "*simple*" one; when associated with the introduction of foreign bodies, accompanied by hemorrhage or pain, "*complicated*."

All the above wounds are described as being "*open*," the outer part of the wound so gaping as to expose the deeper parts, this term being applied in contradistinction to the "*subcutaneous*" wound, or that in which the external wound is very small in comparison with the internal.

Incised wounds, as made by accident or operation, *gape* much when the divided tissues are on the stretch, or the wound transverse, and in some localities this gaping of the wound is more marked than in others, the elasticity of the skin and possibly its muscularity influencing this result. Thus, in the sole of the foot and palm of the hand, the separation of the edges of a wound is very slight, when in the full mammary gland or in other parts of the body in which there is abundance of fatty tissue beneath the skin, the gaping is very great.

The skin is the most elastic tissue in the body, and retracts on division more than any other; arteries, probably, stand next, and muscles third, these points being well exemplified in a flap amputation.

The "*bleeding*" that attends an incised wound depends entirely upon the size, number, and character of the vessels divided. In most people the division of *capillaries* stops by natural processes, except in subjects of the hemorrhagic diathesis. *Venous* bleeding also, except from large trunks, usually soon ceases on elevating the part or on the application of a little steady

with another cloth, folding in the edges to prevent the escape of the mass, and apply the thick side to the surface or wound. The exclusion of air retards the melting of the ice, and the thick layer intervening between it and the surface prevents painful or injurious contact; for injuries to the abdomen this expedient seems very applicable. Dr. W. H. Doughty, of the U. S. A., speaks highly of it. Circular No. 3.

pressure. *Arterial* hemorrhage will be profuse when from large vessels, or persistent till the bleeding vessel has been secured by torsion or ligature.

The *pain* attending an incised wound varies in its nature and degree, according to the sensibility of the patient and position of the wound, the pain of anticipation doubtless aggravating it in the case of an operation.

TREATMENT.—*To arrest bleeding* is the surgeon's first aim, and in the chapter on hemorrhage the necessary means have been discussed. *To clean the wound* by the removal of all foreign material is the next, and this is to be done by the fingers and forceps of the surgeon, and a stream of water over the part, aided by cotton-wool, clean sponge, or tow. The less manipulation the surface of the wound is subjected to the better.

Where primary union is wanted, the cut surfaces and *edges of the wound are to be brought into apposition* by means of sutures and probably strapping, these objects being materially assisted, when the wound is a deep one, by pads and the pressure of a bandage. Indeed, in the treatment of all large wounds, whether the result of accident or operation, in which primary union is a want, the benefit of a little firm pressure over the part is very great, in some cases a pad of lint being the best, in others cotton-wool, while the whole is kept together by some good strapping or a bandage. In some cases, where the edges can be brought together without sutures or strapping a pad of dry lint fixed over the part by a bandage is good dressing. Small and superficial wounds may be brought together by strapping, sutures being only employed when the length of wound is too extensive, or there is too much gaping, or where, as on the face, strapping cannot be accurately applied.

In superficial wounds the flexible collodion of the British Pharmacopœia is an excellent application, the edges being held in apposition, whilst it sets. Two or three coatings should be applied.

In wounds where sutures are not required, and the edges can be brought together, lint saturated with the compound tincture of benzoin is the best application.

Sutures in superficial wounds may be put in superficially, but in deep wounds must be put in deeply. To adapt the skin surfaces of a deep wound without procuring apposition in the deeper parts is bad practice, and where union takes place tends to harm, by holding in the secretions. Sutures are not, however, to pass through muscles. There are four chief kinds of sutures: the *interrupted*, *uninterrupted*, *twisted*, and *quilled*.

The **interrupted suture** is the one usually employed in ordinary wounds. It is made with a curved or straight needle, according to convenience, armed with a single thread of well-waxed silk, the fine silk line as sold by tacklemakers being the best. The needle is then introduced through one side of the wound from without, inwards, obliquely through the tissues, and made to pass through the opposite side in the same direction from within, outwards. The edges of the wound are then to be carefully drawn together, and the two ends of the suture fastened in a double reef-knot. A granny (page 166) is by no means a bad knot to make, as it is a slip-knot, and may be tightened at pleasure, a third knot securing the whole. The knot of the suture should be brought to one side of the wound (Fig. 194); and in fastening the suture it is only necessary to draw the knot tight enough to keep the edges of the wound in apposition; they are not to be strangled, as illustrated in Fig. 194. In a large wound sutures and strapping may alternate; in others the sutures may be inserted about half or three-quarters of an inch apart.

The **uninterrupted**, continuous, or Glover's suture, is usually employed where a very close and accurate adaptation of the margins of the wound

is wanted, as in wounds of the intestine, of the eyelid, of the face, and of the penis after circumcision in the adult. For this purpose the needle should be small and the silk fine; it is the stitch of the seamstress. Fig. 159 (page 289) illustrates the thing as applied to the intestine.

In both these forms of suture the stitches should be removed on the third or fourth day; from the face they may often be taken out on the second. If left in long they set up irritation and ulceration.

FIG. 194.

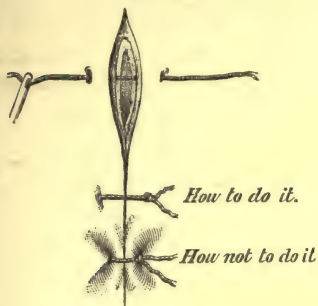
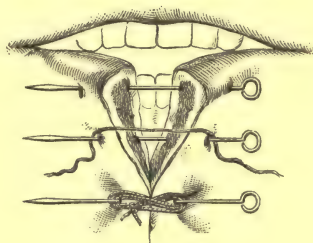


FIG. 195.



Wire, iron, or silver sutures are liked by some; they are thought to be less irritating than silk. I have tested them together in the same wound on many occasions, and have failed to find this true. They are not, however, more irritating, and may be used. They need not be tied, a double twist being sufficient to secure their ends. Wire sutures at times, however, set up very little irritation. Gut or horsehair seems to be the least irritating materials we possess for sutures; in plastic operations they should be used.

The **twisted suture** is the one which used always to be employed for bringing together the parts after the operation of harelip; it is now often so used, as well as in cheiloplastic operations and others on the face and abdominal walls. To apply it, some fine pins with flat heads, silk, and cutting-pliers are wanted.

The pins are employed to bring the *surfaces* of the wound in contact. In lip cases the point should be introduced half an inch or more from the margin of the wound, and passed obliquely through its thickness down to, but not through, the lining mucous membrane (Fig. 195). It should then be introduced into the opposite side and brought out through the skin at a corresponding point. With a piece of silk the wound may then be drawn together by means of a figure-of-eight twist around the two ends. Should the apposition of the surfaces be imperfect, the pin should be taken out and readjusted, and in this lies the great advantage of this form of suture. A second and third pin may then be introduced in the same way. After the silk has been tied in knots and the ends cut off, the points of the needles ought to be removed, and the soft parts protected, if necessary, from the ends by a small piece of lint or strapping passed beneath.

Instead of silk being twisted round the pins, a section of an india-rubber tube, in the form of a ring, has been employed by Mr. Gariel much in the same way as Henry Lee applies his india-rubber over a pin employed for varicose veins, either of the extremities or testicle. I have tried the plan in many cases, and find it good, but no better than silk.

The **quilled suture** is a very valuable one, in deep wounds tending more

than any other to keep the deep parts in apposition. In plastic operations in the perinæum in the female it has always been a favorite, and although I gave it up in these cases for many years in favor of metal sutures, I now use it with good success. In gastrotomy it is probably the best we possess for holding equably the margins of the open stomach to the margins of the wound, and in other cases of abdominal cysts, ovarian and otherwise, in which the same end is wanted, a like practice should be adopted.

For the application of this suture a strong curved needle with an eye at the end and threaded, is to be inserted at least three-quarters of an inch from one margin of the wound, and made to pass well down to its depths, being brought out through the other margin in a corresponding line. The loop of the suture is then to be caught and held, the needle being withdrawn; a second or third suture is then to be applied in the same way.

FIG. 196.

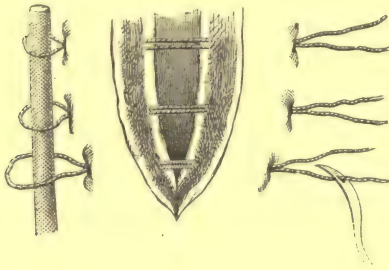
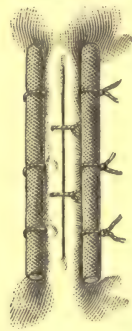


FIG. 197.



One of two pieces of bougie, cut the required length, is then to be introduced into the loops, and fixed by drawing the free ends of the ligatures home (Fig. 196); the second piece of bougie is then to be tied in the same way on the opposite margin of the wound, the parts having been well cleansed previously, and carefully adjusted. The surfaces of the wound are only to be held closely in apposition; they are not to be pressed too firmly, otherwise the bougies will set up ulceration. Superficial sutures may be introduced into the edges of the wound. (Fig. 197.)

For the quill suture good fishing gut is better than silk or wire; it is very strong, and less irritating. It should be soaked in warm water before to make it limp; it can be readily tied or fastened with a shot.

The quill suture should generally be removed by cutting the loops of the sutures on the fifth or sixth day, this point turning on the amount of irritation it causes.

After-Treatment of Wounds.—When the edges of an incised wound have been brought together, they require very little dressing, a piece of dry or oiled lint being sufficient.

On the third or fourth day, when union has probably taken place in wounds of moderate size, the dressings and sutures may be removed, the edges being kept from gaping by the application of a piece of strapping as the sutures are removed, and the whole being covered with lint where healing by granulation has to follow, or left open when union has taken place.

In large or deep wounds where pads and pressure had been primarily applied, it is a better plan to leave the dressings untouched for five or six days, and then only to remove them when evidence exists of the presence of some retained or irritating secretions. When doubt exists as to these

points, some of the dressings should be taken away to allow of discharge taking place. It is better at times even to allow sutures to cut out than to disturb a wound in which quick repair is wanted and anticipated.

Punctured Wounds.—When these are made with *sharp* and *clean* instruments, and do not involve any important or diseased structures, they generally do well. When small, they do as well as the incised; when large, they are not so prone to unite by primary union.

When made, however, with *blunt* pointed, *rough*, or *dirty* instruments, they never heal kindly, for the parts are *bruised* and *torn*, as well as separated, by the perforating instrument, and close again as soon as the instrument is withdrawn; thus blood, and at a later stage, broken-down tissues, are retained, and should these decompose or mechanically irritate by their presence, inflammation is set up with its local and constitutional symptoms. Should important parts be thus injured, or the tissues be unhealthy, these results will be worse, and very serious consequences may then be looked for.

When tense fasciæ, as found in the palm of the hand, sole of the foot, and scalp, or when deep muscles bound down by fascia, as in the thigh, are punctured, and such results ensue, the consequences are severe.

It is probable that it is the bruising and tearing of the tissues that makes them worse than the incised, for bruised and torn tissues rarely heal by primary union.

TREATMENT.—All punctured wounds, great or small, are to be treated with more caution than the incised; the parts should be kept at complete rest and elevated, a pad being carefully adjusted over the wound, and equal pressure applied to the parts. When all goes well, and repair ensues, the dressings may be left for four or five days, and then removed, the parts still being kept at rest for another week.

Should pain or swelling follow this primary dressing, and increase, the dressings should be at once removed and warm water applications or a poultice applied. When there is any evidence of retained fluid in the part, the external wound must be opened, the extent of incision required depending upon the amount of tension of the part. When suppuration has taken place, a free vent for the discharge must be maintained. Pain must be relieved by opium, and the general powers maintained by tonics and stimulants carefully supplied.

Arrow Wounds.—These have been made the subject of a special essay by Dr. Bill, in the "American Journal of Med. Science," vol. xlv. He tells us that it is exceptional to meet with single wounds, the American Indians discharging their arrows so rapidly that if one takes effect it is immediately followed by others. The Washington Army Medical Museum contains specimens of penetrating arrow wounds of the skull, and where both tables are punctured there is little or no fissuring externally or internally, the vitreous table being penetrated as cleanly as the outer. "This is in such marked contrast to the results of bayonet or sword thrusts or of the impact of gunshot projectiles, as to merit notice."

Arrow wounds of the chest are not always fatal; those of the abdomen are generally so. Dr. Bill tells us that the Indians on this account always aim at the umbilicus, and that the Mexicans when fighting the Indians, on this account always envelop the abdomen.

The velocity of the arrow when first projected is so great that it has been estimated to nearly equal that of a musket-ball. At a short distance it will perforate the larger bones without comminuting them or causing a slight fissure only, resembling the effect of a pistol-ball fired through a pane of glass a few yards off. This is well seen in the drawing (Fig. 198), taken from a preparation of the section of the eleventh right rib of a buf-

falo, fissured by an arrow, in the Washington Army Med. Mus., presented by Prof. Joseph Henry, and copied from Circular No. 3.

FIG. 198.



Surgeon-General's Office, U. S. Circ. 3. Piece of buffalo rib pierced by arrow.

The treatment of punctured vessels and cavities will be found in the chapters respectively devoted to those subjects.

Contused and lacerated wounds never heal by primary or immediate union. The injured parts are so bruised and separated that some portions of their surfaces are sure to die, and thus healing by granulation is to be looked for. They do not bleed like the incised.

They are, nevertheless, to be treated with care, and as if they mean to unite partially, if not wholly. After their surfaces have been cleansed and freed from blood and dirt their edges may in many cases be brought together, sometimes by sutures, in others by strapping, care being always taken that the whole of the wound be not covered in, and that a free orifice is left for discharge. The surface of the wound may be covered with oiled or wet lint. The parts should be well raised and kept at rest.

In the skin-lacerations of extremities, it is surprising at times to find how well the parts heal under this treatment, and how large portions of integument that have been torn off, when carefully readjusted, unite and maintain their vitality; when the parts are so injured that a fear of sloughing from want of arterial supply is felt, the whole should be wrapped up in cotton-wool.

Water or oil-dressing with or without opium, carbolic acid, or other drug, may be applied after the primary dressing has been removed, according to the wants of the case.

Subcutaneous wounds are interesting subjects of study, for surgeons are now familiar with the fact that tendons, muscles, and even bones may be freely divided with a very small cutaneous wound, and good repair follow, without any signs of inflammation, suppuration, or constitutional disturbance. When a tissue is divided, and its two divided surfaces are left in contact, they will unite as any other wound; when they are separated, the space between them will be filled in with new material, that will organize and assume in time the characters of the divided tissue—at least, such changes occur in tendons.

These facts render the subject one of great interest, and tend to make the surgeon look out for opportunities of applying the practice to a more extended class of cases.

The treatment of subcutaneous wounds resolves itself into closing the wound with a pad, and leaving the parts alone, allowing them to heal; and the quiet way in which this takes place contrasts most favorably with the repair of open wounds. The non-admission of air, not of "germs," being, probably, an explanation of the difference.

This subject will be more fully considered in the chapter on the surgery of tendons.

CHAPTER XXXVII.

POISONED WOUNDS.

UNDER this heading, *Dissection Wounds*; wounds from the sting or bite of healthy insects and animals, and wounds from the bite of diseased animals, or inoculation from their blood, will be considered.

Dissection wounds are very common, and it is exceptional to find them followed by any ill effects; they, in common with all wounds, may be attended with absorbent inflammation, inflammation of the cellular tissue, suppuration, ichoræmia, or pyæmia; and feeble or cachectic subjects are more prone to any one of these consequences than the strong and steady.

In exceptional instances, however, different results follow, and two forms of the affection may be recognized,—the *mild* and the *acute*.

"The symptoms in the *mild* form partake," says Poland, "more or less of the ordinary character of non-specific inflammation, and scarcely present any noticeable characteristic signs; thus, the local appearances consist in the puncture assuming a defined red aspect, which soon becomes pustular; this bursts, and ends in an unhealthy suppuration; there is surrounding erythema of an erratic form, and inflammation and pain extending along the forearm and arm to the axilla, ending in the enlargement and suppuration of the glands. The constitutional effects consist in febrile disturbance, loss of appetite, diarrhœa, fetid eructations, &c. The prognosis and termination are favorable; and the treatment required is to be based upon general principles. The symptoms of the *acute* or severe forms are those of a truly specific disease; the local signs commence by the appearance of a small circular or oval vesicle over the seat of puncture, which soon becomes turbid, milky, and pustular, and not unfrequently has a defined margin, resembling somewhat that of small-pox. This is generally unattended with pain; but the patient often complains of intense pain in the shoulder and about the axilla, which shoots down the chest. The glands in the axilla are early affected, and seem to act as barriers to the further progress of the poison; they become enlarged, and the surrounding cellular tissue is implicated, with serous effusion; there is erythema and puffy swelling; these extend to the subscapular and pectoral regions, spreading down the side of the chest, yielding to pressure, and imparting a peculiar spongy feel. There is, besides, an oedematous and doughy condition of the arm and forearm, owing to serous exudation into the cellular tissue, which seldom, if ever, passes into suppuration."

"The constitutional symptoms are at first those of strong excitement; but these are soon followed by those of extreme depression of spirits and much suffering. Rigors, headache, prostration of strength, vomiting, &c., supervene; and, lastly, all the symptoms of low typhoid fever rapidly set in."

In some cases the absorbent glands are not involved, and death may occur from prostration in the early stage of the disease. In others, suppuration and pyæmia may appear, whilst in a third class extensive and diffused sloughing of the skin may ensue; all these points being materially influenced by the power of the patient to throw off morbid influences.

The *prognosis* in these acute cases must be unfavorable. Travers gives it that one in seven recovers, probably this is rather in excess of what is true; but if the patient does not sink during the violence of the attack, his powers will be tried to the utmost by the protracted suppuration.

The inoculation from a recently dead body is far worse than from an old dissecting-room subject, and the fluids from a patient who has died from

glanders, peritonitis, and scarlet or puerperal fever, are far more dangerous than any other. Indeed, there is reason to believe that the contact with such fluids is capable of giving rise to the disease without any local wound or abrasion.

The poison probably acts upon the blood and nervous system.

TREATMENT.—To keep the patient alive during the progress of the disease and treat local symptoms, as they arise, on general principles, is the usual method now pursued.

Every student when he pricks his finger should at once clean and suck the wound, arresting the circulation through it, by pressure with the opposite hand on its cardiac side, he should do this for at least a minute. The part may then be closed over, a piece of gutta-percha skin made adherent with chloroform being an admirable application. When the wound is free and the poison is from a recent puerperal or allied case, some caustic, such as the nitrate of silver, chloride of zinc, or even nitric acid, may be applied. The two first are probably the best. Should any inflammation appear, a poultice should be applied, the hand raised above the shoulder, and if tension of the part be present it should be at once relieved by an incision.

Spreading, absorbent, or cellular inflammation should be treated by fomentations, some surgeons having faith in the local application of nitrate of silver, iodine, or the solution of the perchloride of iron, to arrest its progress. The glands when enlarged should be freely bathed with hot water, and hot fomentations kept on constantly. The earliest indications of suppuration should be looked for in order that pus may be at once evacuated. Sloughs are to be let out by moderate incisions. Tonics should be given from the first, iron when it can be borne, with or without quinine in full doses, or ammonia and bark when these tonics are inapplicable. Nutritious food is to be given in abundance, milk being the best drink; stimulants when needed, but always with caution. Country air, as soon as it can be enjoyed, is the great aid upon which reliance can be placed for recovery.

Anatomical Tubercle.—This is a chronic skin affection, which is to be met with on the hands of those constantly engaged in making post-mortem examinations. Dr. Wilks, when describing some models of the affection that are to be seen in the museum (Fig. 199), has called it "*verruca necrogenica*" ("Guy's Rep.," 1862). In its early stage it is not unlike epithelial cancer, and should be generally recognized; as a rule, "it commences without any evident breach of surface, the parts affected being not those liable to pustules, as the back of the hand or wrist, but the knuckles and joints of the fingers. If the disease should begin with a pustule, the latter bursts, but instead of healing, a thickening of the cuticle takes place around it, and as from time to time a little fresh suppuration occurs, so the thickening and induration increase. Generally, however, these changes go on slowly, without any preliminary vesication. A warty thickening of the epithelium takes place, which, in course of time, becomes of a dark color, until a kind of ichthyotic condition is produced."



Model Guy's Mus. 193^{oo}.

The disease is a local one and is unattended by constitutional symptoms. The repeated application of the strong tincture of iodine, acid nitrate of mercury, or nitric acid, will effect a cure.

Insect Stings in this country are not very severe, and, unless inflicted in large numbers, rarely require professional aid. Some little fever and constitutional disturbance may follow in children who are susceptible to external influences, and in others, local swelling, heat, and redness are very marked. Should a wasp or bee accidentally be taken into the mouth with fruit, and the base of the tongue, pharynx or larynx, stung, serious symptoms may appear from the oedema and swelling of the parts impeding respiration. When this accident happens, scarifications should be employed with fomentation, but if life be threatened the air-passages must be opened.

When the tongue is the part affected, the sting should be removed, when possible, with a pair of fine forceps, and in other cases, where this can be done, much pain is saved. The best application is the liquor ammoniæ or sal volatile; a drop of either of these applied to the part after any insect-sting generally gives relief. The parts should also be protected from the air by collodion, flour, chalk, or strapping.

In the tropics, the bite of the scorpion, the tarantula, and other insects, is, however, more troublesome, the accident being often followed by nerve depression, vomiting, and local pain. In South America, the mosquito bite is often followed by severe local inflammation, and sometimes ulceration. In Africa and Asia, the scorpion, which is often from six to ten inches long, is so venomous as to cause at times loss of life. Olive oil is the usual application for the wound, but the liquor ammoniæ is probably better. Brandy and ammonia should be given internally when great depression exists.

The bite of the spider is in its effects very similar to that of the scorpion; the wonderful stories about its poisonous qualities are now believed to be fabulous.

Serpent Bites are often serious, and at times fatal, the venomous poison being squeezed into the tissue in the act of biting from a special apparatus situated at the base of the upper fangs. In England, the *viper* is the only poisonous reptile, and although some local and constitutional disturbance may follow its bite, a fatal termination is rare.

The *cobra di capello*, *rattlesnake*, *whipcord snake*, and *phoorsa snake*, are the most venomous.

In some cases the poison seems to spend its effects upon the nervous system, killing by convulsions or coma; in others, its local effects are the more important.

Dr. S. Weir Mitchell, of Philadelphia, who has carefully studied the effects of poison by the rattlesnake, tells us, that the bite is very variably followed by bleeding, but soon by swelling and discoloration of the injured part and tissues around, these symptoms depending upon the effusion of blood into the cellular tissue. Pain of a pricking or burning character also follows, gradually becoming more intense. The wounded extremity becomes larger and the pain greater, the skin assuming a mottled marbled aspect. As a secondary effect, inflammation of the tissues follows and disorganization, the inflammation assuming more the character of the phlegmonous erysipelas, associated with glandular enlargement and suppuration, gangrene being a common consequence.

With these local changes the constitutional are in accord, great depression of the nervous system and general prostration being the most prominent symptoms, with profuse cold sweats, vomiting, dyspnoea, diarrhoea; jaundice often precedes death.

When the dose of the poison is great, or the susceptibilities of the patient acute, the general prostration of power and local stagnation of blood in the wounded extremity sometimes kill at once; and in a keeper of the London

Zoological Gardens, who was bitten in the nose by a cobra, half an hour only had elapsed when he was apparently dying, being unable to speak, swallow, or support himself; the pupils were dilated, face livid, heart's action feeble, and he was scarcely conscious. Death took place in little more than an hour from the infliction of the wound.

Mitchell has recorded a fatal case in five and a half hours. One died comatose, another with dyspnoea and dysphagia, a third felt sleepy, and died without agony.

On the other hand, patients at times recover suddenly, even when the symptoms have been severe, as if the poison suddenly lost its influence. More commonly, however, death ensues, and when recovery follows, it is only after severe local suppuration and sloughing, leaving a maimed and useless limb.

After death, Mitchell found ecchymoses in the thoracic and abdominal viscera, the spots containing blood-cells, this exudation being purpuric in its nature, and clearly caused by a want of the normal coagulating power in the blood; indeed, this altered condition of the blood is the most common effect of snake poisons, and in some cases it is said to last through life; thus, in bites from the Indian phoorsa snake there is said to be a hemorrhagic tendency during life. After death Mitchell could never detect the least alteration in the blood-cells in acute cases, and in exceptional examples of chronic poisoning he found a few globules indented. In chronic cases, also, where time for the poison to act upon the blood has been allowed, the want of coagulating power in the blood is very constant, putrefactive changes rapidly following.

Dr. Halford, of Melbourne, says, he always found the blood after death dark and fluid. He found it also to contain germinal nucleated cells, which he regards as molecules of living foreign matter thrown into the blood from the venom, which increase and multiply at the expense of the oxygen normally wanted in inspiration, and hence, it seems, arise asphyxia and death.

Dr. Fayrer, of Calcutta, tells us, however, that he has never been able to detect these changes in the blood, although the blood is affected by the poison, and through it the nervous centres. ("Indian Annals of Med. Science," 1870.)

TREATMENT must be most energetic, otherwise the depressing influence of the poison will soon paralyze all action, a few seconds being enough for the absorption of the poison.

Locally, the aim should be to arrest the absorption of the poison into the circulation by fastening a ligature firmly on the cardiac side of the wound, by excising the wounded part, and the application of nitric acid, carbolic acid, or the nitrate of silver.

Fayrer records, that the natives of India apply a ligature not only just above the bite, but at several places on the limb at intervals of some inches. The danger and difficulty lie in not applying the ligature quickly enough. The ligature must also be tightened to the utmost, till the circulation is entirely arrested, and the part is livid with retained blood. The punctures should then be scarified to allow the blood to flow freely, and then the cautery or caustics should be applied. The Indian natives place a live coal upon the wounded part.

The man who is dying from snake-bite is perishing from rapid exhaustion of nerve-force. *Constitutionally*, the best practice lies in the administration of ammonia and stimulants, to maintain the action of the nervous and circulatory systems, and thus keep the patient alive whilst the poison

is worked off or becomes exhausted. Any other measure that can rouse and stimulate the failing nervous energy may be employed.

Fowler's solution in full doses every half hour for four hours has been said to have been useful. Iodine has also been advocated, and olive oil in full doses internally highly praised. In countries where poisonous snakes abound, different roots have their reputation, such as the guaco, the *sacraevitæ ancora*, *radix corinæ*, decoction of Virginia snake-root, &c., &c.; but Fayrer, after repeated experiments, believes them to be utterly useless.

Halford has thought, by his experiments, that the injection of twenty to thirty drops of a solution of one part of the strong liquor ammoniæ to three parts by measure of water into one of the veins of the wounded limb, accompanied by the local application of the liquor ammoniæ to the part, is a specific; but Fayrer, of Calcutta, who has tried the practice, has failed to find the success he looked for. Mitchell advises ligature to the cardiac side of the wound, excision, amputation, or destruction by cautery or escharotics of the poisoned part; and even *suction* of the part directly on its receipt, the poison having no influence in the stomach.

He thinks well also of the injection into the wound of iodine or ammonia, and says the natives believe the local application of olive oil to be the best. With this local treatment, the patient's mind is to be kept up by hope, and his heart going by stimulants, quite irrespective of quantity, the general powers being maintained by nutritious food. By these means, "if the person be not thoroughly poisoned, we may help him to recover. If he be badly bitten by one of the more deadly snakes, we can do no more" (Fayrer).

Bites of Diseased Animals.—Hydrophobia, meaning the "dread of water," or "*rabies*," is a disease contracted from a rabid animal, and generally from its bite through its saliva; it is always fatal.

In the *dog* there are three well-marked stages of the complaint. The *first* is the *melancholic*, characterized by melancholy, depression, sullenness, and fidgetiness; the *second*, the *furiosus*, by excitement, by rapid fury; and the *last*, the *paralytic*, by general muscular debility and actual *paralysis*.

"The dog," writes Trousseau, "looks ill and sullen after a period of incubation of very variable length; he is constantly agitated, turning round and round inside his kennel, or roaming about if he is at large. His eyes, when turned on his master, have a strange look in them, expressive of sadness as well as of distrust. His attitude is suspicious, and indicates that he is not well; by his wandering 'he seems to be seeking' for a remedy. He is not to be trusted; if he obeys at all, he does it slowly; if you chastise him he may, in spite of himself, inflict a fatal bite. His agitation increases; if in a room, he runs about looking under the furniture, tearing the curtains and carpets, sometimes flying at the walls, at others jumping as if to catch flies; the next moment he stops, stretches his neck, and seems to listen to a distant noise. He probably has then hallucinations of sight and hearing."

"This delirium," says Youatt, "may still be dispersed by the magical influence of his master's voice; all these dreadful objects may vanish, and the creature creeps to his master with the expression of attachment peculiar to him."

"There follows then an interval of calm; he slowly closes his eyes, hangs down his head, his fore legs seem to give way beneath him, and he looks on the point of dropping. Suddenly, however, he gets up again; fresh phantoms rise before him; he looks around him with a savage expression, and rushes against an enemy which only exists in his imagination. By this time the animal's bark is hoarse and muffled; loud at first, it gradually fails in force and intensity, and becomes weaker and weaker. In some cases the power of barking is completely lost; the dog is dumb, and his

tongue hangs out through his half-opened jaws, from which dribble a frothy saliva. Sometimes his mouth is perfectly dry, and he cannot swallow, although in the majority of cases he can still eat and drink. When he cannot drink, he will lap fluids with great rapidity, but on looking closely it will be seen that he merely bites the water. He can still, in some cases, swallow solids, and he may then swallow anything that is within his reach, bits of wood, pieces of earth, straw, &c."

"Towards the close of the second stage of rabid fury the dog often breaks his chain and runs away; he wanders about the fields, being seized from time to time with paroxysms of fury, and then he stops, from fatigue, as it were, and remains hours in a somnolent state. He generally dies in a ditch or retired corner, apparently from hunger, thirst, and fatigue."

Veterinary surgeons do not say that he dies from asphyxia, brought on by spasm of the pectoral muscles or by convulsions. The disease runs its course in from five to eight days. It is the same in the dog, cat, horse, and wolf, and from any of these man may become inoculated.

In man the disease may show itself at any period from six weeks to a year after the inoculation, this *incubation* stage varying greatly. Thamhayn ("Schmidt's Jahrbuch," 1859), in an analysis of 220 cases, showed that in 49 the symptoms appeared within a month, in 98 during the second, in 29 during the third, and in 26 during the fourth month, 16 of the remaining cases showing themselves within twenty-six months, two cases only maturing at a period of four and five and a half years respectively. But these cases are always doubtful; they are probably examples of hysterical or *nervous hydrophobia*.

These conclusions are supported by M. Bouley's "Returns on Hydrophobia in France," 1863 to 1868. Académ. des Sciences.

The disease may attack the infant at the breast, or the aged, the male or the female, and during the incubative stage there is no disturbance of the general health to be observed. Van Swieten has pointed out, that during this period such a disease as variola may run its course without any modification, two poisons thus coexisting together in the same frame.

After the incubative stage has passed, the first symptom usually displayed is one of sadness; the victim either does not suspect his complaint, or carefully avoids mentioning the circumstance. His sleep will be disturbed; he is fidgety, sighs deeply, and avoids society; noise seems to trouble him; many are very irritable and ill-tempered. The second stage will be marked by an aggravation of all these symptoms, but in addition pain in the region of the heart will be present, and some irregularity of the pulse. Rigors will soon appear, which, says Trousseau, "are true convulsions of all the muscles of the body;" and lastly, the characteristic symptom of dread of water, not as fluid, however, but as connected with the difficulty of drinking. The sight of water is frequently sufficient to bring on shuddering, but it is when the patient carries water to his lips that he is seized with the typical terrors. A rabid man is always rational; he tries to drink, but the attempt excites terror and the expression of his inability. His eyes become fixed, features contracted, and his countenance expressive of the deepest anxiety, his limbs shake, and whole body shivers. The paroxysm lasts a few seconds, and then subsides into quiet, but only to be recalled on the slightest breath of air touching his body, for *hyperæsthesia* is one of the most marked symptoms of the affection.

During the calm, nausea or even vomiting may appear, and priapism is often a most distressing symptom. Sudden terror of an unknown kind haunts the mind, imaginary callings of fiends often existing. Dr. Ber-

gerons records a case in which the patient heard the ringing of bells, and saw mice run about in his bed.

In the third and last stage the longing for drink becomes intense, but the inability to take it greater; the voice becomes hoarse, and the mouth full of a frothy fluid. The patient tries to get rid of this by spitting, and then becomes frightened at its results; in some cases he fears that by contact this fluid may propagate the disease. Convulsive seizures increase in frequency and intensity, the spasm of the respiratory muscles threatening life; at last a fatal spasm takes place, and death by asphyxia ensues.

In the dog death is from paralysis, in man generally from asphyxia; in exceptional cases it is from exhaustion.

This painful affection rarely lasts longer than four days; it has been fatal in sixteen hours, and has lasted as long as two or three weeks. Thamhayn shows by his figures that 56 out of 202 cases died within forty-two hours, 73 in forty-eight hours, 38 between the second and third days, 19 between the third and fourth days, 7 existing five days, 5 six days, and 4 seven days.

The seat of wound or cicatrice rarely shows anything unusual; in three or four cases out of a hundred it may be slightly painful, irritable, or inflamed, or the seat of a neuralgic pain, the pain being a kind of "aura," as in epilepsy; in some instances this is very severe.

Diagnosis.—There is no disease like hydrophobia, taking it as a whole. In a certain sense, it resembles tetanus, yet the two diseases, in their general features, are unlike; they may, however, occur together, so good an observer as Dr. Ogle having published a case of combined tetanus and hydrophobia in the "British and Foreign Medico-Chir. Review," 1868.

What Trousseau has called nervous hydrophobia, may, however, be mistaken for it—true dysphagia, brought on by a dread of rabies; "but the sudden invasion of this complaint, generally coming on through the person recalling to mind or hearing the relation of a case of true hydrophobia, and the duration of the dysphagia over the period of four days, are amply sufficient to characterize the complaint, and to enable the practitioner to persuade the patient that he is suffering from mere nervous symptoms, which will vanish as soon as he ceases to fear. Besides, in nervous hydrophobia there is dysphagia only, but no general convulsions, the spasm affecting the pharynx alone, while the breathing goes on with regularity."

In the very early period of the disease, during its incubation, Drs. Marochetti, Magistel, and Xanthos, have called attention to the presence of pustules or vesicles near the frænum of the tongue, known in Greece as *lyssi*; if these *lyssi* are cauterized, all manifestations of disease are said to be prevented. Other observers have said the same, and led Trousseau to suggest that this eruption should be searched for in persons who have been recently bitten by a rabid animal, and whose wounds have not been cauterized; for should this fact be confirmed, a means of diagnosis will be found of great value, and also a means of treatment at the very earliest stage of the disease. These *lyssi* are said to show themselves at an earlier period in proportion to the amount of poison deposited in the wound. Marochetti made early incisions through the vesicles, and then cauterized the surface with a red-hot iron, and, he said, with invariable success.

Pathology.—There are no pathological lesions peculiar to hydrophobia—at least none such have as yet been described. Mr. Durham, in a case that occurred at Guy's in 1865, carefully examined the cord, prepared after Mr. L. Clarke's method, and found extreme congestion of the gray matter of

the cord, and numerous minute patches of extravasated blood in different sections.

The disease appears at all seasons and in all climates, not being influenced by any external cause. It is, in man, always the result of inoculation.

TREATMENT.—In all cases of bites from dogs or animals in which the faintest suspicion exists of rabies, free cauterization with the lunar caustic should be performed. Youatt states that he has adopted this practice in upwards of 400 persons, and four times on himself, with complete success, and in all these cases there was no doubt as to the dogs being mad. With such a result no other caustic need be used; when this is not at hand, any acid, caustic alkali, or cautery, will do. When the escharotic cannot be obtained the part may be excised, and during this proceeding a ligature may be fastened on the cardiac side of the wound. Some surgeons advise amputation.

Mental stimulants, in the way of giving hope and dispersing fear, must be freely administered, and such general treatment as may be needed. No drug has yet been found that has the least influence on the disease, either in preventing or curing it. Dr. Marochetti's treatment of the lyssi is the only one that approaches successful treatment. How far the constant administration of chloroform would influence the disease is a question that may fairly be put to the proof, such drugs as promise to be of use being administered hypodermically. To prevent asphyxia from taking place, tracheotomy, as suggested by Dr. Marshall Hall, is a justifiable operation; it has never been performed on the human subject for the purpose, but it is based on a good theory. By it the immediate risk of death from asphyxia would be rendered impossible, and time given for remedies to act, or the disease to run through its course. It seems six or seven days is the outside period for the disease to be in existence; if life can be prolonged thus far, the hope of a good result may be entertained. Anything that will tend to prevent death, and thus keep the patient alive, is good. Tracheotomy is one of these means, and deserves trial, wine and food being good adjuvants.

When a dog is known to be mad, it had better be destroyed; but when any one has been bitten by a dog in which no evidence of madness exists, the animal should be kept, although apart from others, and guarded, for time will prove the truth of his condition, and do away with the morbid fear of "rabies" that may have been excited by the injury.

Glanders.—This is a specific disease given to man by inoculation from the horse. Dr. Elliotson first recognized its true nature, and described it under the term Equinia. It shows itself under two forms. In one it attacks the mucous membrane of the nose and neighboring glands—"glanders." In the other it affects the lymphatics of the body generally, giving rise to tumors or a knotty condition of the subcutaneous glands, which are called "*farcy buds*," the disease being then called "*farcy*."

In man these two forms are generally found together.

There is said to be a stage of incubation varying from two to fifteen days from the inoculation, febrile symptoms with excitement then appear, followed by the specific eruption. The pains of the limbs that accompany the febrile condition are generally associated with tenderness wherever glands exist, and on examination some enlargement of these glands will be found. The eruption is very characteristic; it is made up of a crop of vesicles, becoming pustular, which are very hard, and more like those of variola than anything else. They are arranged in groups, with inflamed bases; the face, neck, and abdomen being, as a rule, more covered than the extremities; when close together, they become confluent. These pustules, with

their indurated masses, then soften down, leaving ulcerated excavated surfaces. They affect the mucous lining of the nose, giving rise to the discharge. Virchow says that "these so-called pustules are really due to the presence of a tenacious deposit in the corium of the skin, that has much resemblance to tubercle, and microscopically is made up of an amorphous granular appearance mixed with cell-elements, cell-growths, and fat-globules." ("Handbuch.") And this opinion is supported by the clinical fact that tubercles are so often found in farcy in the subcutaneous tissue, appearing as hard circumscribed blind boils, or more or less diffused swellings. These soften down and give rise to extensive sloughing of the skin and parts around, rarely being absorbed. During the progress of the disease soft tumors appear about the body, not unlike pyæmic cutaneous abscesses, sometimes attacking deeper parts. In the more advanced stages of the disease these tubercles or so-called pustules attack the larynx and whole respiratory tract, and more particularly the lungs, giving rise to Virchow's pneumonia of glanders, this affection consisting of a series of tubercles beneath the pleura covering the lungs, surrounded by lobular pneumonic inflammation, as in pyæmia. These tubercles are said to have been found in the testicles, kidneys, pancreas, and joints.

When these tubercles attack the nose, which they usually do at an early period, and often before they appear in other parts, the secretion from the nose is at first catarrhal, thin, and clear; subsequently thick, tenacious, and puriform, often mixed with blood; but as often as not this nasal discharge is absent or not noticed till a later period of the disease. The face and head often swell from œdema, presenting a puffy, erysipelatous, shining surface; the conjunctiva also secretes a thick secretion, gluing the eyelids. The tonsils are frequently involved, and often suppurate. As the disease progresses the swellings and discharge increase; the inflammation around spreads and becomes gangrenous; bullæ appear on the skin; the constitutional symptoms become typhoid; a low delirium sets in; and death, not unlike that from pyæmia, ensues, with coma and exhaustion. When the glands and absorbents are involved, as in the farcy form, suppuration and sloughing, with all other local conditions, are superadded to those already given.

The *prognosis* of glanders is most unfavorable, recovery only taking place in the mildest cases of poisoning. The disease in its acutest stage may prove fatal in a week; indeed, it has run its course in three days, but in general it lasts for three or four weeks, and in very chronic cases life has been prolonged for months. In chronic "farcy," where sloughing glands have left large sores, these may remain open for a long time; occasionally such chronic cases end by an attack of acute disease.

The post-mortem appearances have been well described in two recent cases, in both of which there was absence of nasal discharge. One was Dickinson's case; and the second, Poland's, from whose paper, in "Holmes's Surg.," vol. i, I quote. One died on the twenty-first day. The blood was found fluid; the muscles soft and rotten; the cervical and left parotid glands suppurating; the lower part of the right lung solid with gray hepatisation; its tissues completely broken down and infiltrated with purulent fluid; the left lung studded with numerous patches of a slate color, and of the size of hazelnuts.

The second patient died on the thirteenth day. There was no affection of the lymphatic glands, but suppuration in the muscles of both calves of the legs, and local abscesses in other parts of the body, chiefly in the muscles; the joints were free from suppuration; there were recent patches of lymph on the pleura, lobular pneumonia in the base of the upper lobe

of the right lung, in a state of gray hepatization; the lower lobes of both lungs throughout contained smaller hepatized masses; the liver was free from disease.

Billroth lays great stress on the presence of hemorrhagic abscesses in the muscles as being characteristic of the pyæmia of glanders.

In man the poison is generally communicated through the nasal discharge from the horse and the discharge from farcy swellings. Where the inoculation takes place in the latter method, the disease in man is more of the character of farcy. It can be communicated from man to man.

This poison, to be absorbed, requires, as a rule, a wound or a delicate membrane, yet cases are on record where the disease has been set up by the wiping of the face with unclean hands or cloths.

Youatt states that the disease is not one-tenth part so common as it was, and, "generally speaking, it is only found as a frequent and prevalent disease where neglect and filth and want of ventilation exist."

Glanders, writes Dr. G. Milroy ("Trans. Epidem. Soc.," vol. i), is a *gen-erable* as well as a *propagable* disease; it is extremely apt in some seasons to develop itself in foul, unventilated stables; its development may, however, be controlled even to absolute prevention by the observance of simple sanitary rules.

TREATMENT.—To keep the patient alive and to treat symptoms upon ordinary surgical principles seem to be the best modes of practice. There is no drug that has any influence on the disease. Give fresh air when possible; support the strength by good food, not too stimulating, and give tonics, such as quinine and iron; soothe pain by sedatives; when the nose is a source of trouble, keep it clean by washing, a stream of water passed through the nostril, followed by some antiseptic lotion, such as carbolic acid, Condy's fluid, or creasote, nitrate of silver solution, tannic acid, and others more stimulating, being at times of value. Where the throat troubles, sponge it with some nitromuriatic acid lotion, and use the chlorate of potash gargle.

Abscesses and softened tubercles should be opened early and freely, poultices and fomentations being kept on the parts. Where they are very numerous this practice is, however, a difficult one to follow. Perfect cleanliness should, of course, be observed.

Glanders in the Horse, Mr. Youatt tells us, in his book on that animal, is chiefly to be recognized by the persistent *discharge* from the nostril, and the singular *hardness* of the submaxillary gland and its adherence to the bone. These glands are not very large except at the commencement of the disease. They are neither hot nor tender, yet the adhesions are the result of an effusion of inflammatory lymph around the glands.

When any doubt exists as to the nature of the disease, the inoculation of a condemned horse or ass with the nasal secretion will reproduce the disease in a few days.

Equinia mitis is a local pustular disease affecting the hands and body of those who dress the heels of horses affected with "*grease*"—an inflammation and swelling of the heels of the horse, attended with the secretion of a thin acrid matter. It is not unlike ecthyma, but more angry; the pustules are about the size of a sixpence; they suppurate on the third day, dry up about the tenth or twelfth, forming scabs, which leave cicatrices. The disease runs its course, and is to be managed by rest and cleanliness.

CHAPTER XXXVIII.

BURNS, SCALDS, CICATRICES AND THEIR DISEASES.

Burns and Scalds.—A burn is caused by the application of concentrated heat to the body; a scald, by the application of hot or boiling liquid. As a rule, scalds are less severe accidents than burns, as water, the ordinary fluid through which the scald is produced, is never hotter than 212° Fahrenheit; but when any chemical compound is the scalding medium, the effects are at least often as bad as the worst burns. The worst local burn I ever saw was when a man put his booted foot and ankle into a pot of molten lead. It came out covered with a boot of metal, but destroyed even to the bones. Mr. Aston Key amputated the limb at once below the knee, without removing the metal.

A moderate degree of dry heat applied in the pursuit of a calling in-durates the skin and blunts its sensibility. Thus we see an ironworker or a blacksmith manipulating pieces of iron that would "burn" ordinary people. Thus some skins or parts of the body are more sensitive than others, and under the same influence may be differently affected.

The effect of heat, when applied to the body, varies according to its *intensity* and the duration of its application; it may cause a simple redness of the surface or the death of the part. Thus its *first* morbid effect is mere *redness* and tenderness of the surface; after a brief period of hours these symptoms subside, the cuticle possibly desquamating.

In the *second degree* of heat inflammation is the result, manifesting its presence by the formation of a *blister*-raised cuticle, from the effusion of serum.

In the *third degree* the superficial layer of the true skin is destroyed, the *surface appearing* of a *gray-yellowish or brown color*, not painful unless roughly handled. The vesicles that exist contain a blood-stained or brown fluid. The papillæ of the skin, with its nerves, are first destroyed; but when, in the course of a day or so, the dead surface has been "shed" and the nerves exposed, the pain is very severe, the exposed surface having a reticulated aspect.

In the *fourth degree* the whole thickness of skin is destroyed, with more or less of the subcutaneous cellular tissue, the parts being converted into a hard, tough, dry, and insensible eschar, mottled with blood; vesication does not exist in this degree, all the superficial tissues having been destroyed. The skin surrounding the eschar may be blistered, but where it comes in contact with the injured part it will be drawn into folds from the contraction, by drying, of the burnt integument, this puckering fairly indicating the important fact that the whole skin has been destroyed. The eschar does not begin to separate for four or five days, an inflammatory zone of redness, with pain of some severity, indicating the commencement of a process that will not be completed for two or three weeks. When the slough has come away, the cellular tissue with the deep parts are exposed, a long and tedious process of suppuration and granulation having to be gone through for its repair.

In the *fifth degree*, the skin with the deeper parts are involved—a black, brittle, charred mass taking the place of healthy tissues.

In the *sixth degree*, the whole thickness of a limb is carbonized.

These divisions, originally made by the great French surgeon Dupuytren, so well accord with all observation that they have been invariably adopted

by modern surgeons; and although, in burns and scalds, one degree passes imperceptibly into another, and in bad cases coexist, in the main points they can be made out.

Next to the *intensity* of the heat and *duration* of its application, the *extent of surface* involved is the most important point; indeed, as regards life, it is of far greater importance than the other two. For a superficial burn, spread over a large surface—although not locally so injurious as a more severe one—is more fatal; indeed, in the majority of cases of death from burns and scalds, more particularly in children, the risk to life is fairly to be measured by the extent of surface involved; when more than half the body is injured a fatal result generally takes place; a severe burn of a limited character may be only a local affection.

Thus, the danger to life turns upon many points. In the young and the old all burns or scalds of any extent are serious. At all ages extensive burns, however superficial, are to be feared, and these are serious from their immediate depressing effect upon the system, patients dying from shock, and the worst cases being marked by the sensation of *coldness* and persistent *shivering*. When the period of shock has passed—a period varying from twelve to forty-eight hours—and that of reaction has set in, other dangers appear. Should the injury be over the thoracic cavity, chest complications may be looked for; if over the abdomen, intestinal troubles. Burns and scalds of the head are not so prone to be followed by intracranial mischief as those of the chest are by thoracic. All intestinal complications should be carefully observed, for there seems to be a liability to irritation of the intestinal mucous tract, that goes on at times to ulceration. Dupuytren first observed this generally, but Long ("Lond. Med. Gaz.," 1840) and Curling ("Med.-Chir. Trans.," vol. xxv) showed that ulceration of the duodenum, as proved by inspection after death, and indicated during life by vomiting and purging of blood, is by no means an infrequent result. Pathologists, generally are not, however, agreed upon this point.

In this *second* or *inflammatory stage*, the injured parts are being thrown off, and most writers grant about fourteen days for this process, but in some cases it is less, in some more. When the slough has, however, separated, and the parts begin to suppurate, the *third stage*, or that of *suppuration*, has commenced; and although in this stage there may be less probability of visceral complications appearing, there is the equally great fear of exhaustion, hectic, or pyæmia. And when these fears have passed, or have been proved futile, there is yet the long and tedious process of the healing of the granulating surface, and at a still later period the evils connected with the gradual contraction of the cicatricial tissue. This contraction only takes place when the *whole* skin has been destroyed. When only the surface of the skin has been involved, and not its depth, the sore, on the removal of the slough, has a peculiar net-like appearance, by which it may be known, granulations projecting through the meshes from a whitish or yellow ground.

When a person dies from a burn within forty-eight hours, he dies from shock or collapse, pain doubtless often adding to its influence; when he dies during the stage of reaction or inflammatory stage, it is from visceral complication; when during the third or suppurative stage, from exhaustion, visceral changes, or pyæmia.

When a person is said to have been "burnt to death," he dies from suffocation, the fumes of the fire destroying by asphyxia, and the fire subsequently burning the body.

Half the cases of burn admitted into a hospital die, and half of those that die do so within the first three days.

Out of 408 cases consecutively admitted into Guy's, 275 were in females, 143 in males, the majority being in children under five years old. Dr. Steele has also shown in his "Septennial Report of Guy's," 1868, that out of 195 cases of burns from fire, 60 per cent. died; of 169 scalds, 16.5 per cent. died; of 18 burns from gas explosions, 11 per cent. proved fatal; and of 28 cases of burns from gunpowder, 14 per cent. died, the difference between these classes of cases being very great, burns being four times as fatal as scalds, these half as fatal again as gas explosions, &c.

Pathology.—Holmes has gone into this question better than any author ("System," vol. ii), and has given us an analysis of 68 fatal cases examined after death. Nine died from shock in the first two days, all being children; 17 from exhaustion, 5 within the week, and 12 at later periods. In 3 cases in which the scalp was burnt, erysipelas proved fatal; in 3 pyæmia, and in 2 tetanus; in 11 cases of children cerebral complications caused death, and in most of these they appeared soon after the accident; in 6 cases inflammation of the larynx proved fatal, evidently from the direct inhalation of the flame; in 12 cases, in all of which the burn was thoracic, chest complications killed, and in 4 only did abdominal mischief prove fatal. Out of these, one had peritonitis, the result of a deep burn; two had hemorrhage from ulceration of the duodenum, and one had vomiting from the same cause.

Holmes and Erichsen also dwell upon the fact that cerebral and general visceral congestions are always present in fatal cases; indeed, in all, the congestion is a passive condition, due to the "sudden revulsion of blood from the surface," caused by the skin injury.

With respect to intestinal complication, it seems that out of Holmes's and Erichsen's 125 fatal cases, 16 presented ulceration in the duodenum, 5 of which died during the first week and 5 in the second, the situation of the burn in all but two being on the chest or abdomen. "The ulcer always has an indolent aspect, and is situated below the pylorus; often there are two or three close together; the edges of the ulcers are not raised nor everted; there is little or no evidence of inflammatory effusion in their neighborhood; when they are recently formed, they look simply as if a portion of the mucous membrane had been cut out; but when the ulcer has penetrated more deeply, so as to threaten perforation of the gut, lymph may often be found effused on its peritoneal surface. Sometimes the glands of the duodenum may be found enlarged" (Holmes).

The symptoms of duodenal ulceration are most obscure; neither pain nor tenderness exists; diarrhœa is neither constant nor excessive; vomiting is perhaps a more common symptom, and the presence of blood in the motions is highly suspicious. When the ulcer has perforated the intestinal parietes, intense pain, vomiting of blood, melæna, collapse, and abdominal distension mark the fact.

It should be noted that cicatrized duodenal ulcers have been found in patients who have died of other complications.

TREATMENT.—In all burns great care should be observed in removing the clothes and in saving the cuticle. Blisters should be carefully punctured and their contents evacuated, the raised cuticle being gently pressed down to the true skin and covered by dressings. When the patient is cold or shivering exists, he should be covered with a warm blanket and placed near the fire, some wine or brandy and hot water being given. Professor Hebra speaks well of the warm bath under these circumstances. When the injury is extensive, one part should be uncovered and dressed before the other, for a free exposure of the surface tends to increase the shock and add to the pain.

As pain is the constant concomitant of all burns and scalds, and the

exclusion of the air from the injured surface is the best means of neutralizing it, the surgeon's object has been to find some method of treatment by which this result can be secured, and at Guy's Hospital the application of carron oil, equal parts of lime-water and linseed oil, applied on lint and covered with cotton-wool, has long been the favorite remedy, the whole being carefully kept in place by a bandage. At University College the burnt surface, of whatever degree, is well covered with the finest wheaten flour by means of an ordinary dredger. At the London Hospital the application of zinc ointment on lint is employed. Dr. S. Gross, of America, uses white lead paint, and more recently powdered clay has been employed. The dressings must not be changed for some days, not, indeed, until they have been loosened by the discharges or become offensive, for the process of dressing any large burn is necessarily a painful one, and consequently an injurious one. For this reason carbolic acid has been dissolved in the oil, in the proportion of one part to ten or more.

Small burns or scalds may be treated by water-dressing, lead lotion, collodion, Friar's balsam, gold-beater's skin, flour, chalk and water, &c. Two parts of collodion to one of castor oil is also a good application. In superficial burns this treatment is probably all that is required, the cuticle being reformed in three or four days, and beyond some increase of redness in the parts convalescence is at hand.

When the *first* dressing has been removed, and the surgeon is able to make out the extent of tissue injured and the depth of the sloughs that are expected to separate, the character of the dressings may be altered, for it is best to hasten the sloughing process, which may be done by some stimulating dressing. Lister's carbolic oil, made of one ounce of carbolic acid to a pint of olive or linseed oil, is very good, or an ointment made of carbolic acid $\mathfrak{z}\text{iv}$, lard $\mathfrak{z}\text{iv}$, and castor oil $\mathfrak{z}\text{j}$; but these drugs will not do when a very large surface is involved, and under such circumstances they had better be applied to the sloughing parts, and the carron oil, or zinc, calamine, resin, or creasote ointment, $\text{℥}\text{x}$ of the last to an ounce of lard to the other parts. A lotion composed of one drachm of the compound tincture of iodine to a pint of water is a good one. Sloughs, as they loosen, should be cut away, but never dragged. Deep sloughs are well treated by poultices, the turpentine ointment hastening their separation. When the surface is granulating it must be treated as any other open sore, and when the entire thickness of skin has been lost, as in burns of the fourth degree, the surgeon's closest attention is needed to counteract the contraction of the wound that will take place, and thus prevent the advent of those frightful deformities with which all are too familiar.

This is to be done by extension, applied in some instances through mechanical appliances, in others by means of bandaging and strapping. When strapping is used, the pressure should be exerted over the granulating surface as well as over the cicatricial border. The strapping must be good and made of linen, thin calico, and leather yielding too much; in the majority of cases nearly all requirements can be met by these means. The process of extension must be kept up during the whole period of granulation and cicatrization. Thus in burns of the anterior surface of the neck the chin must be extended to the utmost from the sternum; in those of the thorax the arm must be kept from the side; where the groin and parts around are involved, the thigh must be kept extended, &c., &c.

In addition, however, to these means, M. Reverdin, of Paris, has recently introduced for our adoption his method of skin grafting, a practice consisting of the transplantation of small portions of true skin, or of scraped cutis—skin dust—these centres of cutification not only rapidly growing in

healthy granulations, but having the power of imparting to the granulating tissue a skin-forming power which is as remarkable as it is beautiful to witness.

By these means large granulating surfaces may not only be rapidly healed, but healed without such a surface of cicatricial tissue as necessarily exists in ordinary burns or sores, and without, therefore, that tendency to subsequent contraction that appertains to cicatrices.

This suggestion has introduced us to a new field of surgery, which promises to make a large class of cases that were previously an opprobrium to our art as remediable as many minor affections.

It will receive due attention in a distinct chapter.

When a hand or finger, foot or toe, is charred, amputation must be performed; where the soft parts are so injured as to slough, the same practice must be adopted; where a large portion of the body is thus affected, an opportunity for treatment is rarely afforded, the accident being fatal. The time and also the necessity for operation must be left to the judgment of the surgeon.

The constitutional treatment of burns, in the first stage, is to *prevent collapse* by the judicious use of stimulants and external warmth; *allay pain* by local treatment and soothing drugs, such as chloral or morphia; *maintain the powers of the patient* by simple nutritious food, such as milk, beef tea, eggs, &c.; and *after* the stage of reaction, when that of suppuration has set in, by good food of all kinds and tonic medicine.

Complications are to be treated on ordinary principles, always remembering that the injury is a depressing one, and that it needs no additional depressing influence in the way of treatment.

Thoracic complications may be met with moderate doses of tartar emetic and salines, with nutritious and possibly stimulating diet.

Abdominal complications, with opium, alkaline remedies, such as lime-water in bark or sarsaparilla, and simple diet.

For children an opiate is best, given in the form of the opium ointment; and for adults, where the drug upsets digestion, the same plan is a good one.

Scalds of the glottis have been considered in chapter xxi, p. 138.

Burns and Accidents from Lightning occur but rarely in this country. I have never seen a case, consequently all my knowledge is book knowledge. Holmes, who has written a careful compilation on the subject, says: "A person struck by lightning is usually more or less completely deprived of consciousness at the time. This is a consequence sometimes of the shock given to the brain, and is accompanied by more or less paralysis of motion and of sensation, common or special. Sometimes, and perhaps more usually, it is the effect merely of fright, and is then only transient. The insensibility sometimes lasts for a considerable time. The paralysis by which it is usually accompanied may last for an indefinite period; in one case it lasted four months, in another three. This paralysis is more common in the lower limbs than the upper. Other affections caused by lightning are burns, eruptions of erythema or urticaria, loss of hair over parts or the whole of the body, wounds, hemorrhage from the mouth, nose, or ears, loss of sight, smell, speech, hearing, and taste, or, in rare cases, exaltation of these special senses, cataract, imbecility, or abortion. It sometimes leaves arborescent marks on the body, even on parts covered by clothes, which have often been described as a kind of photograph of neighboring trees or other objects. Persons not killed on the spot usually recover, some dying from exhaustion; recovery is hastened by tonic treatment; galvanism is

good in paralysis. Burns caused by lightning are deep and obstinate; sometimes, however, mere vesications; they must be treated as other burns."

In sudden deaths from lightning the shock to the brain is the cause; the heart is found flaccid and empty, the blood sometimes coagulated, and Taylor tells us that, from Sir C. Scudamore's experiments on animals with electricity, the same conditions existed.

The Diseases and Treatment of Cicatrices.—Cicatrices or scars, however produced, grow with the growth of the individual, and, at the same time, have a tendency to disappear, so that indurated scars may, indeed, in time become non-indurated. In small scars this is often observed, and even in large ones it is so occasionally, the large cicatrices of burns becoming soft and pliable. As often as not, however, the opposite occurs, and the disposition to contract is a very formidable one, producing deformities of a frightful kind; those of the neck are, perhaps, the most hideous. The arm may be fastened to the side (Fig. 200), and I have seen the head of the humerus displaced beneath the coracoid process and the development of the upper extremity arrested by the contraction; indeed, there is no limit to the effects of such a powerful and constant force as that of cicatricial contraction.

FIG. 200.

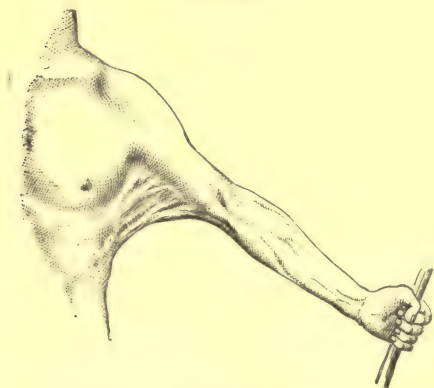
Axillary cicatricial web
after burn.

FIG. 201.

Mode of applying extension
after its division.

The surgeon is called upon not unfrequently to remedy these defects, and where his efforts are successful the surgery is satisfactory, but too often the result is far from what is wanted.

The operation consists in the free division of the cicatrix and its subjacent tissues, the subsequent extension of the divided parts during the healing process, and the transplantation of different centres of "cutification" during the granulating stage, after the method of Reverdin.

In dividing the cicatrix the incision may be directly across the scar, running into healthy tissue on either side, or in the form of a natural or inverted V, according to the line of induration, the V flap being dissected from the tissues beneath; or a number of small incisions may be made, subcutaneous or otherwise. But in all these divisions the surgeon must remember that the seat of the contracting cicatricial material is in the subcutaneous tissue as well as in the skin, and that unless that be divided no permanent good can be looked for; indeed, it is on this point, and upon it alone, that a prognosis can be based. The most favorable cases for opera-

tion are those in which a web of tissue connects an extremity with the body, or the chin with the chest, for such a web contains within itself most of the cicatricial material upon which the deformity depends, and on its division the whole will be freed. Great care is, however, needed in the division of these webs, for they often contain important parts, such as nerves and vessels that have been displaced by the contracting process. Thus, recently, in treating a case in which the right arm was fixed by a web from the axilla and elbow to the chest, the web seemed to be so cutaneous that I was half tempted to perforate with my knife and slit it up. Had I done so, in the position I had noted, I should have passed my bistoury across the brachial plexus, artery, and biceps muscle—these parts having been completely drawn across to the thorax by the affection—and have then been forced to amputate the extremity. I did, however, what I would always advise others to do—divide the parts carefully and deliberately, and thus steered clear of any harm. I brought also a piece of healthy skin from the posterior part of the wound and fixed it to the anterior, about the lower border of the axilla, thus dividing the large exposed surface by a bar of healthy integument, and kept the arm at a right line to the shoulder with a splint extending from the elbow to the hip. When the wound had assumed a healthy aspect I inserted ten pieces of skin, the size of hempseed, and after this cicatrization went on with wonderful rapidity, the child being now quite well, with a natural arm and movable cicatrix. In this case I have fairly indicated the points upon which a successful operation is to hinge: Free but deliberate division of the cicatrix and subcutaneous tissue; extension from the first, during the healing process, by some fixed mechanical appliance; and skin transplantation when the surface of the sore has assumed a healthy granulating surface; the surgeon, where he can, partially detaching a piece of integument from one side and connecting it with the opposite, in order to divide the wound, and thus increase its skin margin for granulation. Where a bend in a joint exists this practice is still more valuable. After the operation the wound should be dressed with oiled lint, and covered with cotton-wool, as in a burn. Fig. 201 illustrates a simple method of applying extension of the arm after the division of an axillary cicatrix of great size. Fig. 202 illustrates the effects of a burn upon the neck.

FIG. 202.



In *deformities affecting the jaw*, in which immobility of the bone has been produced, Esmarch and Rizzoli have proposed the division of the bone at the fixed side and the excision of a small wedge of bone, with the view of making a false joint. The operation is a sound one, and has recently been done with success by Mr. C. Heath. In suitable cases it should be repeated.

Ulcerating Cicatrices are not uncommon, an old scar breaking up and becoming the seat of an indolent sore, when its possessor has been weakened by any fever or exhausting process. I have seen this occur over and over again in adults, as they get old or feeble, in cicatrices received in infancy. In one case I have before me the cause of the scar was a burn, in

another it was an injury, in a third an operation, but in all the scars were alike, and they underwent the same degenerating process. These sores require to be treated by rest and local stimulants, the patient being given tonics and good food, to improve the weakened powers. In one case I transplanted with complete success. These "cicatricial sores" are, however, always obstinate, those over the ends of bones the most so.

Warty and Cheloid Scars are classed together, for it is a difficult thing to distinguish the indurated, lumpy, warty scar from the true cheloid. The former, however, appears directly after the wound has healed, and is clearly connected with the healing process, and the latter attacks any scar at any period of its existence.

The thickened warty scar appears as an induration of the whole cicatrix, and is often associated with heat and irritation. It is best treated by local stimulants, such as iodine or blistering fluid, the object being to break up, by some local inflammatory process, the lowly organized fibrous production.

Cheloid Tumors grow as indurated smooth tubercles, at first having a red or pinkish color, but as they increase becoming pale. They are at times painful, or, at least, irritable. They rarely attain a large size, and had better be left alone, for they are apt to return in the cicatrix formed after their removal. Cheloid tumors generally grow from cicatrices. These cheloid tumors are known as those of Alibert, to distinguish them from those described by Dr. Thomas Addison, who, in 1854 ("Med.-Chir. Trans.") described another form of cheloid which he called the "true cheloid," the induration beginning in the skin and subcutaneous areolar tissue, and often going on to produce such a contraction of the part affected as to resemble the indurated cicatrice of a burn. Figs. 203, 204 represent the two affections.

FIG. 203.



Cheloid of Alibert.

FIG. 204.



Cheloid of Addison.

(From models in Guy's Museum.)

The cheloid tumor which follows the perforation of the ear for an earring is a curious form; this, from the deformity it causes, should be excised with a portion of the healthy lobule. They seem less liable to return than other cheloids.

Cancer may attack a scar, and when it does the scars are generally old ones. Thus, I have just treated a man who had a cancerous lip, the dis-

ease having developed in a large scar he had received fifty years previously; it began as a thickening of the scar, and then showed as a tubercle, which grew, broke down, and ulcerated, the ulceration rapidly spreading. Cancers mostly appear after this fashion. They are usually epithelial. They are to be treated by the removal of the growth.

I have lately, December, 1871, been called upon to amputate above the knee in a man, *æt.* 54, a leg stump that was the seat of a frightful cancerous disease. The cancer had existed for two years, and had appeared in the cicatrix of an old amputation performed fifty years before for gangrene after fever (Fig. 205).

Painful Cicatrices are often due to the divided ends of the nerves being bound in by the cicatricial tissue; as often as not they are caused by a bound-down bulbous growth at the extremity of a nerve. In a case I had some years ago the external popliteal nerve, as it wound round the head of the fibula, was so bound down by the cicatrix of a burn as to cause severe agony in the whole course of its distribution. The symptoms were relieved by two free vertical incisions through the cicatrix, and the patient recovered. Should I see a like case I shall do the same thing, but subsequently transplant pieces of skin in the wounds as soon as they assume a healthy appearance. When the pain is due to an adherent or bulbous nerve, the nerve must be freed and removed. When doubt as to its condition exists, Mr. Hancock's suggestion to divide subcutaneously the suspected nerve may be adopted. Where no such causes as have been mentioned are to be made out, the case may be treated as one of neuralgia by full doses of quinine, arsenic, iron, and local sedatives, the extract of stramonium or belladonna rubbed down with glycerin being good applications. Cases, however, of painful stumps or cicatrices are sometimes met with that defy treatment.

Congenital Cicatrices are met with in practice. Thus, I have seen a woman who had a cicatrix in her upper lip as if she had been operated upon for hare-lip (Fig. 92), and bridles connecting the lip with the gum in an unusual manner are not uncommon.

FIG. 205.



CHAPTER XXXIX.

ON SKIN GRAFTING.

WHEN John Hunter a century ago succeeded in transplanting the spur of a young chicken from its leg to its comb, as well as into the comb of a second bird, and found that it not only lived, but grew, he probably never dreamt in any flight of his genius that the fact he then established would be so applied in the practice of surgery as to mark an era in its progress, and to bring a class of cases which surgeons were apt to look upon with little interest amongst the most curable and tractable of local affections. And yet this has come to pass, M. Reverdin, of Paris, having on October

16th, 1869, succeeded in transplanting small portions of skin taken from one part of a man's body to the granulating surface of a large sore, under which treatment the ulcer healed. He read the case before the Surgical Society of Paris on December 15th, 1869, and asked, "Is the growth of skin due to the effect of contact or neighborhood, or is it due to proliferation of the transplanted elements?"

Mr. G. D. Pollock, of St. George's Hospital, encouraged by M. Reverdin's success, followed up the practice, and the good results he and his colleagues obtained soon induced all other surgeons to follow in their wake. The facts are to be read in the "Transactions of the Clinical Society" for 1871, and at the present day it may be said that the practice is established.

For more than one year I have very extensively carried it out, and in most instances with success. I look upon the suggestion as a very valuable one, its adoption rendering many cases curable that were not so previously, facilitating the cure of as many more, and giving interest to a class of cases that had formerly but little. In the management of ulcers it is a great boon, and in the treatment of the large granulating surfaces so common after extensive burns, its value cannot be over-estimated; as an adjuvant to many plastic operations, more particularly on the face, and in the case of deformities, it is invaluable.

Under the action originated by the transplanted skin centres, a process of repair goes on which at first appears almost magical; the grafts soon become islets of skin, round which cicatrization proceeds; the margin of the sore receives an impulse in cicatrization, which rapidly extends; and between the grafts themselves and margin of the sore connecting links of new skin rapidly form, which divide the sore into sections. (Fig. 208). By these means large surfaces speedily cicatrize that under former circumstances would have required many months, and that, too, without the contractions and subsequent deformities that under other conditions were too well known to follow in such cases.

The practice seems applicable wherever a large granulating surface exists, and the only essential point to observe is, that the *surface of the sore should be healthy*; this clinical fact including another, that the patient's health is good, for there is no better barometer of health than a sore, its surface assuming a healthy or unhealthy appearance with every alteration in the general condition of the body. I have attempted, by way of experiment, to graft skin upon sores that were not quite healthy, and have sometimes succeeded. In an indolent sore, in which a small patch of healthy granulations sprang up, I have succeeded in securing, by transplanting, a new centre of "cutification," that proved of great value in aiding the healing process; but in a larger number I have failed in securing such an end. It may, therefore, be accepted as a truth, *that a healthy granulating surface is an important requisite for success.*

Upon this basis I will now proceed to consider how the operation is to be performed.

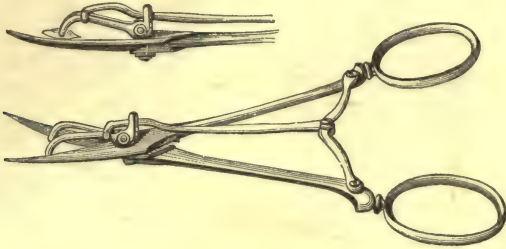
Pollock tells us that Reverdin's method is to remove a very minute portion of the skin, and to replace it on the surface of the granulations, and there retain it with a strip of plaster. "I," he writes, "have usually removed the skin by nipping up a very small portion with a fine pair of forceps, and cutting it off close with sharp scissors. At first I made a slight cut in the surface of the granulations, and then imbedded the piece of skin; but of late I have only laid it on the surface of the ulcer. I cannot say that I have found any difference in the result. I do not think there is great, if any, advantage to be gained by the transplantation of a large piece, but where the ulcer is large I think much is gained by the trans-

plantation of numerous small pieces. The disadvantage of transplanting a large piece is the sore it creates; while the small sores formed by the removal of the minute pieces heal in a short time, and without trouble." ("Clin. Soc. Trans.," vol. iv.)

My own experience confirms in every point that of Pollock.

I employ for the removal of the sound skin a pair of scissors (figured below) which Messrs. Krohne made for me after Macleod's suggestion in a medical journal, and find they answer far better than anything else, for they take away a portion of skin that will cut into three or four pieces, and

FIG. 206.



the section includes only the upper layer of the true skin, with the rete mucosum; they do not cut into the fat beneath the skin, or divide the papillæ sufficiently far to draw blood or give pain. Patients never object, with this instrument, for a second or third piece to be taken away, should it be deemed necessary. I generally take the skin from the fore part of the arm or the side of the thorax.

Having taken away the skin, the fragment should be cut into three, four, or more pieces, and then placed about *half an inch or three-quarters of an inch from the margin of the sore, and about one inch apart*. There is no doubt that the ingrafted centre has a stronger influence in exciting a healing action in the margin of the sore when placed near it, than when isolated in the centre of a granulating surface away from the margin.

These pieces should be placed upon the granulations, and gently pressed in. There is no necessity to wound the granulating surface. They should be covered with a piece of oiled gutta-percha skin, and the whole supported with cotton-wool; a bandage being subsequently applied, so as to press moderately upon the part, and keep the dressing in position. On the third day, but not before, the dressings may be removed, the greatest care being needed; and a fresh piece of oiled gutta-percha skin being subsequently applied.

The appearances of the ingrafted pieces on the removal of the first dressing vary considerably; at times they will seem palpably to have taken root and to be alive; at others to have disappeared altogether; whilst in a third class the surface of the cuticle will be seen floating, as a thin film, upon the secretion of the sore, the basement-membrane of the cuticle—the essential part—being left. (Fig. 207.)

Under all these circumstances, however, the surface of the sore is to be cleaned with the greatest care, a stream of tepid water, either squeezed from a sponge or injected from a syringe over the part, being the best means to employ. The surface is on no account to be wiped, for the grafted portions of skin are easily uprooted, whilst those that appear to have died or that have disappeared often reappear at a later period as "cutifying centres." As soon as the new centres are established in large sores, other pieces should

be ingrafted, at about the same distance from the new pieces as these were originally inserted from the margin of the sore; and in this way the whole granulating surface may be speedily covered with new skin, and a rapid recovery take place.

FIG. 207.

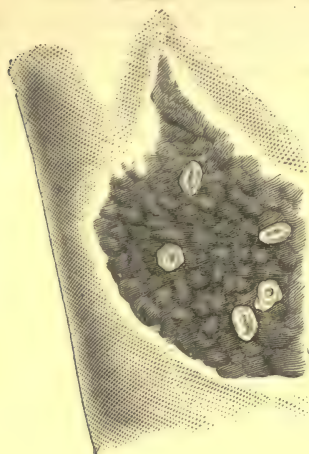


FIG. 208.

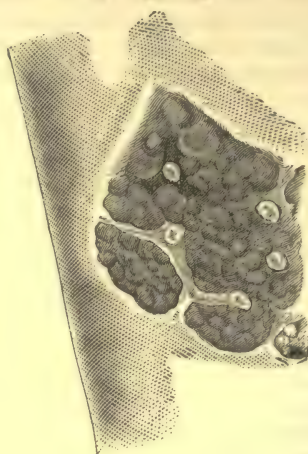


FIG. 209.



FIG. 210.



How the ingrafted pieces act in the healing process is not yet satisfactorily settled, and Reverdin's questions, as already quoted, have not yet been completely answered. That they act as direct stimulants to the sore itself, and more particularly to the margin of the sore, there can be little doubt, for as soon as the "grafts" have taken, the margin of the sore nearest to them is seen to cicatrize, and to send out prolongations of new cicatrizing tissue to meet similar prolongations from the new cutifying centres: the sore in this way becoming subdivided by bands into smaller sores, and then rapidly healing. (Fig. 208.)

That the ingrafted portions grow by the proliferation of their own cells is likewise proved by the fact, that in the case of a white man upon whose

ulcerated leg I ingrafted four small pieces of black skin, the whole being no larger than a barleycorn, the black skin grew twentyfold in ten weeks, to the extent illustrated in Fig. 209, the black portions gradually enlarging and sending out prolongations, which joined, till one patch of black skin had formed, as seen in Fig. 210, the ulcer healing as rapidly where the black skin was grafted, as where the white was placed. The ingrafted pieces of new skin thus themselves grow by cell-development, as well as excite a new skin-forming power in the granulations near which they are placed, and at the margin of the sore; the process of repair by this operation including far more than Mr. Dobson believed when he asserted "that the act of transplantation is simply to insert a pattern of skin, and this pattern is impressed on the granulations to a certain but limited extent; it simply supplies them with a proper model whereby they may fashion themselves." (*Med. Times*, Oct. 29, 1870.)

That the new pieces of inserted skin may do this is highly probable, but that they do what has been already described is undoubtedly true. They grow themselves, they stimulate the skin-forming powers of the margin of the sore, and exert at the same time a like action on the granulations around.

The same result may likewise take place when large pieces of skin are transplanted, whether removed from the patient or from some recently amputated limb. The dressers at Guy's have frequently ingrafted large pieces of skin, half an inch square, removed from amputated limbs; the pieces on removal being dropped into warm water in their passage to the wards where they are applied. But there seems to be no advantage in adopting this practice in the majority of cases, a large proportion of cases failing. In one case the grafts took root, and excited a healthy action in the margin of the sore; they, however, grew but little, and they remained on the cicatrix of the sore, as bosses of skin with well-marked borders; they were grafted, it is true, but the grafts seemed to have no power of assimilating themselves with the tissues on which they were placed.

To take large pieces of skin from the patient's own body is an objectionable practice on account of the large wound it creates; it is, moreover, unnecessary in the majority of cases, as small pieces appear to do better. To take them from another subject is also objectionable for like reasons; but still more so on account of the difficulty that sometimes accrues from a want of power in the new graft to assimilate itself to the tissues on which it is placed, and from the risk that is necessarily run of introducing into the blood of the living subject some new or poisonous element; a risk that I believe it to be wrong and unjustifiable to run, and that I would not allow on my own person. On that account I have forbidden my dressers adopting the practice.

In the case where black skin was transplanted, I did it with the full concurrence of both patients; indeed, both were rather disappointed that the operation could not be repeated. They were firm friends, and the link I formed bound them closer.

There seems, however, no objection to mincing the portion of integument which is to be employed into minute fragments, that is, into pieces the size of millet-seeds; the thumb-nail of the surgeon being the best table for the purpose; in children, where it is unadvisable to remove much healthy skin, and the surface to be covered is large, the plan is a good one; I prefer, however, pieces the size of half a hemp-seed, when they can be obtained. Recently, the practice of applying "skin dust," or the products obtained by scraping the skin, has found favor, and met with some success. In the few cases in which I have tried it, I cannot say I have been successful; the

ulcers healed, it was true, but I have no evidence to show that any new cutifying centres were established by the proceeding. In the hands of Mr. Poland it has, however, been of value. I believe the idea originated with M. Marc Sée, of Paris, who called it "epidermic grafting." I might add, as an objection to the practice, that the scraping of healthy skin is far from painless, and to take dead cuticle is useless.

The clinical points alluded to in this chapter are well seen in the drawings annexed. They have been carefully and ably taken by Mr. Clarke, my reporter, from the living patient, and from some excellent models lately made by our well-known artist, Mr. Towne, from patients under my care in the wards of Guy's Hospital.

They pretend, however, to show only the most striking features in this process of repair, the endless variations in the process requiring the close inspection of many cases.

Whether this newly ingrafted skin possesses the same power of resisting disintegrating changes as the old skin is not yet proved. Some observations I have made lead me to suspect that it is somewhat prone to break down and ulcerate, on the patient walking, after the sore has completely healed, particularly when the subject is past middle age; they are enough to show the necessity of observing as much care in the after-treatment of the case as ought always to be observed after the cure of any other sore; that moderate support and protection are most valuable; and for this purpose there is nothing better than the binding on of a piece of sheet-lead over the cicatrix, when the seat of mischief is on the leg, as by it equal pressure is supplied to the seat of the original sore, as well as protection.

The new skin soon becomes as sensitive as the old; indeed, the sensibility of the cicatrix, under these circumstances, seems to be greater than it is when unaided cicatrization is allowed to take place.

CHAPTER XL.

CHILBLAINS, FROSTBITE, BOILS AND CARBUNCLES, PERFORATING ULCER, BUNIONS, WARTS, DISEASES OF NAILS, ETC.

Chilblains are local inflammations of the skin; they are met with in subjects of a feeble circulation, and are more common in the young, and in women than in men; they are commonly seen on the toes, fingers, nose, or ears, and are caused by any sudden change of temperature, any sudden application of cold or warmth.

They are met with as simple congestions of the skin, attended with tenderness or itching; as vesication of the skin, when the inflammation is more severe; or as sloughing and ulceration of the skin, when a broken chilblain occurs. The disease may begin and stop at the first or congestive stage, or run through all the stages, the experience of each subject telling him or her of what is to be expected.

Towards evening, the symptoms of irritation are always increased, and any external warmth of a fire or bed, any full diet or stimulating drink, is apt to increase the symptoms; in fact, anything that excites the circulation in the part, at any hour of the day or night.

TREATMENT.—The local treatment of chilblains is no less important

than the general, and is more successful; for whilst tonics, good diet, external warmth, and exercise are called for to improve the general powers of the patient and the circulation, local stimulants are of great value. When the chilblain is not broken, the local application of the tincture of iodine, of a solution of sulphate of copper (three grains to the ounce), of camphor liniment, of soap liniment with opium, or one-fourth part of the tincture of cantharides, of compound tincture of benzoin, or of simple spirit, not only gives comfort, but hastens the cure of the disease; the part should also be covered with strapping spread on leather.

When the parts are broken, water-dressing, with the use of thick lint and oil silk or elastic tissue, are the safest remedies, stimulating lotions being used later, when the parts are indolent in healing. Olive oil ʒij, Acid Carbolic gr. x, and Ext. Opii ʒj, is a good formula.

Warm socks and loose shoes or boots are always indicated, anything like tight boots being most detrimental. Exercise should be practiced when possible, and an equal temperature maintained.

Frostbite.—It has been already shown that the sudden application of cold to any exposed part of the body of a feeble or depressed subject is liable to be followed by a "*chilblain*;" and when concentrated cold is applied, under the same circumstances, for a period sufficient to arrest the circulation in a part, a "*frostbite*" is the result. Sudden and severe alternations of heat and cold under exposure, even in healthy subjects, will produce the same result, and in military life this fact is a familiar one.

The first effect of cold upon a part is a sense of numbness and weight, with a feeling of tingling; to the eye, the skin will probably appear redder than usual; if the part be removed from the influence of the cold at this time recovery may follow, or in feeble subjects a superficial "*chilblain*." If the cold be, however, allowed to act still further, the parts will become stiff, and at last insensible, feeling "dead." To the eye, they will assume a white and waxy aspect, and be senseless to all impressions, the blood having been completely driven from the surface. When the cold has been suddenly applied, and is sufficient to kill the part outright, the frozen tissue will have a mottled aspect, from the retention of blood within the tissues. Many of these effects may be produced by the ether spray.

The *constitutional effects* of cold are at first stimulating, and subsequently depressing; excitement passes into sleepiness, and this into torpor. If this be yielded to by the sufferer the sleep will end in death, the blood being sent from the surface to the brain and other viscera, death being produced by blood engorgement, as in apoplexy.

In the "sleepy and depressed stage" of cold, if the patient be brought suddenly under the influence of warmth, and placed too near a fire, the risks of lung engorgement are very great, as well as of rapid gangrene of the frozen parts, for by sudden reaction the arterial circulation becomes quickened, and all the parts become gorged with blood which they have lost the power of propelling onwards. In the gangrene from frostbites there seems reason to believe that ulceration of the duodenum may follow, as after burns. Mr. Adams has recorded such a case in the "*American Med. Times*" for 1863.

TREATMENT.—Few cases require more care, for any sudden alternation of temperature will be most injurious. The aim of the surgeon is to recall the affected parts *gradually* to their normal condition, to assist the venous circulation by gentle friction in the course of the veins with furs or flannel, and the arterial by comparative warmth applied externally, and gentle stimulants administered internally. No warm water, warm air, or fire are to be allowed to approach the parts until the natural temperature has been

partially restored, and then with great care. Friction with snow or iced water has been recommended. On reaction, the parts may be raised and lightly covered with flannel or cotton-wool, or exposed to the warm air of a chamber; food and stimulating drinks carefully given, warm milk with a little brandy being the best. Should reaction be too severe, it must be checked by lead or spirit lotions.

When gangrene follows, and only small portions of the body suffer, such as the integument, the parts may be dressed by some stimulating application to hasten the separation of the slough, and the part generally kept warm, carbolic acid and oil being probably the best application; tonics should also be given.

When large portions of the body suffer, such as the whole foot—and in this country I have seen a coachman, who had on new tight boots, on a bitter winter day, lose both feet—amputation may be called for, the surgeon always waiting till the line of demarkation or limit to the sloughing process is fairly marked.

Boils and Carbuncle.—These affections are, in a measure, allied; they are both due to inflammation of the skin and subcutaneous tissue, the disease probably commencing in the latter. In both there is effusion of lymph into the areolar tissue of the part, and in both this mostly sloughs, although in the boil the slough is local and confined to one central point, whilst in carbuncle the process may cover an extent of integument varying from the size of half a crown to that of a plate.

Boils are met with in two forms; *one* as a subcutaneous swelling, attended with little pain until the skin over it inflames and suppurates, when the conical-pointed swelling, with inflamed indurated areola, causes severe distress, until the parts give way, when the feeling of tension and throbbing is followed by relief, due to the termination of the sloughing process and discharge of the “core.” When the slough has been discharged, an irregular orifice in the skin is seen covering in a cavity in the cellular tissue, which subsequently granulates, leaving a depressed cicatrix.

The core or slough is composed of skin infiltrated with lymph.

The *second* form of boil begins as an inflamed follicle or pimple, with a scarlet, exquisitely sensitive areola. It suppurates slowly, occasionally becoming vesicular, and, as a rule, terminates with a less well-marked slough than the former kind. Such boils are more usually multiple than the last, and are often caused by the application of moist dressings, &c., to a part, or some cadaveric irritant.

With respect to the *causes of boils*, nothing definite can be laid down. That they are always associated with some debilitating or allied cause is belied by daily experience, for they are certainly often seen in men and women in whom no such condition exists; indeed, in subjects who often declare that they “never felt better in their lives.” As a rule, however, this is not the case, for they are often found in subjects who have been either fed to excess, or been subjected to some sudden change in the nature of their diet; in men who undergo training for athletic pleasures, who are subjected to the influence of fetid animal exhalations, as in a skin-yard, pathological room, or dissecting-room. They are seen also in the diabetic and cachectic subject; in patients enfeebled by any fever or other debilitating cause. Gamgee tells us that they are often the result of eating diseased meat. They are also produced by the local contact of certain cadaveric emanations; the post-mortem clerks of our hospitals often suffer when newly appointed, the poison acting at first as a direct irritant upon the follicles to which it is applied. They are far more common in some years than others. In persons who are predisposed to their formation any local appli-

cation is apt to produce them, such as rowing, the application of a poultice, water-dressing, strapping, or a blister. They may attack the integument of any part of the body, the palms of the hands and soles of the feet being apparent exceptions.

In the dense integument of the nape of the neck, buttock, and outside of the thighs, they are more chronic and painful than in the skin of looser texture. They are troublesome local affections, but rarely end badly as to life. In rare instances they are followed by septicæmia and death. I have known this to occur only in one instance.

TREATMENT.—The general treatment of boils must depend upon the condition of the body and the apparent cause of the complaint, any unwholesome habit being corrected, and any evident want supplied. Under other circumstances the practice must be directed on general principles. The diet should be nutritious, but not too stimulating; exercise always short of fatigue should be allowed, and fresh air obtained when possible; the secretions should be looked to, and, when out of order, corrected, mild laxatives being often of use. When the skin is secreting unhealthily, the Turkish bath or warm bath is of great benefit; alkalies or acids are to be given when the condition of the stomach needs them, alkalies and bitters being often of great use.

When debility exists, quinine is invaluable, and in London or large towns its combination with iron is wanted. When diabetes is present, the "feeding" treatment is probably the best. Dr. Jackson, of the United States, gives twelve to sixteen grains of quinine a day, increasing the dose daily until its special effects are produced, and then decreasing it. He continues the treatment for a month. Yeast, in doses of a tablespoonful, taken fasting three times a day, at times appears to have a rapidly marked beneficial effect, but upon what principle it is difficult to say.

The **LOCAL TREATMENT** must be directed much by the local symptoms, it being, as a rule, a better practice to let the boil discharge itself, or dry up, than to lance it. In the early stage of the papular or follicular form of boil, the free application of the nitrate of silver, liquor ammoniæ, liquor potassæ, or iodine tincture, is often followed by its disappearance; but in the other kind all such applications are worse than useless, the abortive treatment in them being unsuccessful.

When the pain is great, from the tension of the part, and the areola of inflammation is spreading, relief may generally be given by lancing the boil; and when the slough is slow in separating, the introduction into the opening of a point of potassa fusa is followed by the rapid cleansing of the wound and its granulation. Poultices may be applied for a limited period during the sloughing stage, but not for long, as they often encourage the appearance of others; water-dressing is generally preferable. When the local inflammation is not great, the plan of covering the boil with a piece of plaster, with a hole in the centre, is a very good one. At times, painting the areola with collodion, or colloid styptic, answers well. When boils succeed one another *seriatim*, without any definite cause, change of air is most successful.

The **Delhi Boil** and **Mooltan Sore** are probably identical diseases, both, according to Messrs. Alcock and Fleming, of the Indian Army ("Army Med. Rep.," 1868), being local diseases, due to the presence of some animal parasite, such as the ova of distomata, which are found in foul water. Professor Aitken supports this view. Dr. John Harley ("Med. Times," Nov. 19, 1870), tells us that persons affected with the parasitic hamaturia of South Africa often suffer from boils and sores similar to the Delhi sores.

The **Fungous Foot of India** has been described by Dr. Carter, of Bom-

bay, in the "Trans. of the Med. and Phys. Soc.," Bombay, 1861, and was supposed by him to be due to the presence of a fungus. Other authors have thrown doubt upon this point, although the disease is well recognized. Berkeley observes, however, that the bodies found in the disease "so nearly simulate fungous growths, that it is difficult to get rid of the notion that they are not really vegetable growths." ("Intellec. Observ.," 1863.)

In the disease, as described by Carter, the foot swells up, is of a dark color, numerous sinuses appear, with pink stains or streaks, which penetrate the subjacent tissues, and end in spherical groups of bright orange-colored particles. The sinuses are more or less lengthy and tortuous, and will not usually yield to pressure of the probe; they often lead to bare bone; the orifices of the sinuses appear as tubercles, with puckered apertures. The sinuses discharge a glairy, sero-purulent fluid. In advanced cases the swelling spreads, and much destruction of tissue takes place. The disease never spreads above the foot. Dr. Carter and others believe that amputation of the affected part is the only sound practice to be adopted.

Carbuncle.—This is a far more serious affection than a boil, for it is almost always met with in the feeble and cachectic subject, and generally in men, rich or poor, over forty-five. It is very frequently associated with diabetes, and gouty people are particularly prone to its attack.

It generally occurs singly, and is slow in its progress, the inflammation in the skin and cellular tissue beneath spreading as a brawny inflammatory effusion, with no defined border. The redness of skin is rarely vivid, more frequently livid; at times the local pain is severe, and constitutional depression very great. The sloughs separate slowly, many openings, as of many boils, allowing them to escape, and the whole skin at times separating as an ash-colored layer, leaving an irregular cavity undermining the neighboring tissues. The favorite seats of carbuncle are the skin and subcutaneous tissue of the nape of the neck, back, and buttock; they occur, however, on the front of the body and the extremities, and at times on the lip or face. The disease is so slow in its progress as at times to occupy many weeks, one part going through its course as it spreads in another. The disease may destroy life by exhaustion, at times by pyæmia, the worst form of pyæmia being found with it; indeed M. Labat ("Med-Chir. Soc. Bordeaux," 1868) believes pyæmia to be the most common cause of death in carbuncle. Rare cases have been recorded in which peritonitis was caused by the extension of the disease from the abdominal walls into the peritoneal cavity.

When the treatment by incision is adopted, life is too often shortened by loss of blood. As a general rule, however, carbuncle is not a fatal disease; its danger depends much upon its extent, and more upon the complications with which it is associated.

TREATMENT.—In former days the one form of local treatment that every surgeon followed was that of the crucial incision +, the knife being passed freely through the tissues to the base of the inflammatory effusion; the object of the incision was to give room for the slough to separate and come away. In modern times the value of this practice has been much questioned, for it was too often found to be followed by loss of blood, where blood was much needed; and it has been questioned whether the incision did much to hasten the progress of the case and the separation of the slough. It is still, however, a popular form of practice. I was taught it, and from observing its effects have long given it up, believing that it did little or no good, and was often followed by a harmful hemorrhage.

The treatment I prefer, and have followed for many years, has been that by caustic, and the more I see of it the better I like it. It has been strongly advocated in this country by Pritchard, and in America by Dr.

Physick. It is applicable in the stage of the disease when the cellular tissue is brawny, and the early inflammation of the skin has subsided; it may be used before any openings in the skin are found, either as Pritchard advises, by rubbing the caustic potash freely in the centre of the carbuncle until an eschar is fully formed, or, which is preferable, by puncturing with a scalpel, and inserting the stick or a small piece the size of a pea; when the carbuncle is large, many punctures may be made, one to every surface of the dimensions of half a crown. Where openings exist, the surgeon has only to insert the caustic and let it melt, either in stick, or, what is better, in pea-like masses, by means of dressing forceps, passing them well down into the subcutaneous tissue. By this practice the slough is certainly cast off more readily than when incisions are made or the case left to nature. No bleeding takes place, and very little pain beyond that at the time. A clean granulating wound soon takes the place of the sloughing one, and a rapid recovery ensues. With this treatment large carbuncles become healthy granulating wounds in a month. The only care required is to prevent the caustic running over the sound skin. During this treatment a poultice may be applied, or some lotion, such as Condy's fluid, carbolic acid, or alcoholic lotion; a solution of opium applied to the part often gives relief to pain when severe. Tonics, good living, and fresh air, are also essential. The French surgeons prefer the Vienna paste; by these means, unless the carbuncle is associated with some serious malady, such as diabetes or pyæmia, a good result may be looked for.

The plan of making a subcutaneous incision has been ably advocated by Mr. French and M. Guérin, and that of compression by Messrs. O'Ferrall and M. H. Colles of Dublin (*Dub. Quart. Journ.*, 1864).

The former plan I have tried, but have failed to find its advantage. The latter I have not employed, having been too well satisfied with the caustic treatment.

M. Gosselin strongly advocates the plan of making deep punctures into the carbuncle, and evacuating them by means of compression.

The best thing, writes Paget ("*Lancet*," 1869), you can do, if the carbuncle is small, is to cover it with emplastrum plumbi spread on leather, with a hole in the middle through which the pus can exude and the slough can come away. When the carbuncle is large he advises the common resin cerate, and over it a linseed-and-bread poultice, perfect cleanliness being observed during the sloughing process.

Facial Carbuncle.—This has been often misnamed "malignant pustule." It was probably first described by a clever young surgeon, Harvey Ludlow ("*Med. Times and Gaz.*," Sept., 1852). It is generally found on the lip, the upper one being the more commonly involved, as an œdematous inflammatory swelling of the part, involving the nose and cheek, often preceded by some pustule or vesicle, and generally accompanied by them. It is almost always associated with severe pain. It ends, as most cases of carbuncle do, with sloughing, and at times the whole substance of the lip or cheek gives way. It is associated, like carbuncle, with great constitutional depression, and often with pyæmia; carbuncular inflammation of these parts, as suppurative inflammation of the neck, being equally prone to be followed by blood poisoning. I have seen only five cases of this affection, three of the upper and two of the lower lip, and all recovered; in only one did the disease extend beyond the lip. In all, the disease, as far as local treatment was concerned, was left to natural processes, cleanliness and fomentations being alone employed. Tonics and good diet were given. Quinine and iron, in full doses, seem the best. Paget advises quinine in sufficient doses to produce symptoms of cinchonism.

M. Reverdin, interne des hôpitaux, gives a very elaborate essay on this subject in the "Archives Générales de Médecine," 1870. At p. 162 of the August number he thus sums up his conclusions:

1. Anthrax and furuncle of the face present a special gravity.
2. This gravity is due to its ready complication with phlebitis.
3. The facial phlebitis is attended with death, either by extension to the sinuses of the dura mater, or by becoming the source of purulent infection.

4. Of anthrax of the face, that of the lips is more frequently complicated with phlebitis than the others. This may be explained by the peculiar texture of the lips.

5. Anthrax of the lips has nothing in common with malignant pustule.

6. The involving of the orbit in the phlebitis, as demonstrated by exophthalmia, shows almost for certain the implication of the sinus.

7. Incision, speedily and extensively performed, seems to be the best means of preventing and sometimes arresting the phlebitic complication.

Malignant Pustule, or Charbon, is a disease with which I have no personal experience. M. Bourgeois, in a work entitled "La Pustule maligne et Œdème malin" (Paris, 1861), has given a full description of it. He tells us it is derived from an animal poison, and that it is communicated to man by direct contact with the body of a diseased animal, or with any material that has been in contact with the disease. It is mostly found on the exposed parts of man, such as the hands and face, and begins as a small, red, inflamed, and itching spot, which in twelve or fifteen hours vesiculates, the skin beneath the vesicle appearing as a dry brown or black slough. In the course of the second day another crop of vesicles appears around the original seat of the disease, which run the same course. About this time the seat of the original disease has become more swollen, appearing as a defined lump ("bouton"), the parts around being œdematous, and the whole subsequently sloughing. In this stage of the disease there is little pain, the slough is always *dry, and there is no pus*, the sloughing spreading from the skin down to the subcutaneous tissue instead of as in carbuncle from the latter to the former.

Malignant pustule is also rapid in its progress, four to nine days seeing its end. It is usually ushered in with rigors and symptoms of depression, followed by vomiting and great depression, often cold sweats and delirium, the patient dying from the depressing influence of the animal poison before its local effects have had time to work. In young subjects the prospects of recovery are greater than in the old, and when the hands are involved the chance is better than when the head is affected.

TREATMENT.—The disease being in its nature local, local treatment is to be preferred, and Bourgeois tells us that the free application of some caustic, such as the potassa fusa, so as to destroy fully the eschar and primary vesicles in their early stage, is the best treatment; and in more advanced cases the excision of the slough and the free use of the same caustic is to be recommended. Tonics, diffusible stimulants, and such means as are usually employed to guard against the tendency to death, are of great value.

Perforating Ulcer of the Foot, so called by Vesigné, of Abbeville, in 1850, is an affection which Mr. Hancock has lately brought prominently before us in an able paper published in the "Brit. Med. Journ.," June 26th, 1869, although Cloquet, Boyer, and Nélaton, of Paris, have described it. Nélaton describes it "as commencing with phlyctæna in the pad of the foot. The epidermis is raised by a small quantity of purulent serum. Others describe it as commencing as a flat corn, which ulcerates. When

this is opened, the subjacent dermis appears of a rose color, and when touched is highly sensitive. This state may continue for some time, when the dermis in its turn gradually ulcerates, and a small fistulous opening is established in the subcutaneous cellular tissue, which will not heal, but continues to discharge serum slightly tinged with pus. If after five or six weeks the sinus is examined by a probe, the subjacent bone is felt rough and necrosed, and a sequestrum subsequently forms."

The disease is probably hereditary; it is most obstinate in its character, generally spreading over years; it is, however, mostly local, and confined to the anterior portion of the foot. Medicine has little power over it, although Fowler's solution has been much vaunted for its cure, but with insufficient evidence, and, as far as facts can guide us, it appears Hancock's conclusion is the only right one, and that is that in the first instance, when dead bone exists, it should be removed. "But if, notwithstanding, the disease returns, there can no longer be a question that when once perforating ulcer of the sole of the foot is established and recognized, it is better at once to remove the whole of the metatarsal bones, either by Chopart's, Syme's, or Pirogoff's amputation."

These cases are not to be confused with the suppurating bursæ or bunions found in feet deformed from short or tight boots.

Warts are growths of the papillæ of the skin, the papillæ being usually elongated and their epithelial covering thickened. They are common on the hands and other parts of the body of the young; they are more rare in the adult. When on exposed parts of the body, they assume a horny hardness; when surrounded with moisture or the secretion of the skin, they are soft and more sensitive.

The flat wart is called *verruca simplex*, the pedunculated *verruca digitata*; and these are said to be more common in the scalp. I have seen them on the neck, orifice of the nose, mouth, eyes, ears, and anus, also on the prepuce and labia. I have seen some on the tongue. They occur at times beneath the nails, and are very painful—*subungual*. The best crop of warts I ever saw was around the anus of a boy.

Venereal Warts are very abundant, whether they grow from the glans penis or prepuce of the male, or labia of the female. They are pedunculated, moist, and highly vascular. They are clearly contagious. They occur at times in these parts without any venereal contact. The flat warts occasionally come and go in a way which is not to be accounted for; as a rule they are, however, persistent. They rarely last into adult life. When they do they seldom grow or give trouble. In exceptional cases, under some local irritation, they may increase and assume more the character of an epithelial cancer. When on the face this change is peculiarly liable to occur. Not long ago I destroyed an epithelial cancer by the ala of the nose, the size of a florin, that had suddenly appeared in a wart that had existed for sixty years, nearly all the patient's life, and I have removed a cancer from the lip of a man that had grown from a wart which had existed as long as he could remember.

TREATMENT.—Some powerful alkali such as ammonia, to dissolve the cuticle, and the subsequent application of the glacial acetic acid, nitric acid, or acid nitrate of mercury, to destroy the papillæ, is the best plan to get rid of the harder or flat warts. Lunar caustic is an unsatisfactory and tedious remedy. Pedunculated *dry* warts should be cut off with the knife or scissors, and the *moist* may be treated in the same way when not too extensive. When extensive, they may be made to dry up by the application of some powder, such as the oxide of zinc, or even starch. Powdered fresh savine is a good application, Mr. T. Smith recommending it to be mixed

with the powdered diacetate of copper. The perchloride of iron in tincture is also good. Venereal warts and others, when extensive, may be readily destroyed by means of the galvanic cautery, the patient being under chloroform. At times excision is the best practice. In the large masses that are found on the genital organs of women, of venereal origin, nothing but the removal of the whole with the labium can be entertained; when the *écraseur* of the galvanic cautery cannot be obtained, the ordinary wire one may be used. The hemorrhage from these venereal warts is generally severe; and the surgeon should never attempt to remove them, when extensive, by excision, without having at hand some good styptic, such as the solution of the perchloride of iron, matico, alum, dry and in solution, or the cautery in one of its forms.

Moles.—Using the word in the broad sense to include small spots of discolored skin and cutaneous connective tissue tumors with pigment, with or without unnatural growth of hair or skin glands, they are very common; few people are without one or more upon the surface of the body, many have them in numbers. I have seen a woman studded all over with hairy moles, the hairs being in some half an inch long and bristly. They are generally congenital, but at times put in an appearance later in life; they are rarely of any greater importance than the disfigurement they produce; occasionally, however, they degenerate or become the seat of a cancerous disease, the melanotic cancer having frequently its origin in such congenital spots. This clinical fact, which is now fairly recognized, is an important one, and renders it expedient for the surgeon to excise any mole that has a tendency to grow or to become indurated in middle life; for melanotic cancer is a soft cancer, as a rule, and, when it has once appeared, is prone to spread and multiply rapidly. Many of the most virulent forms of multiple cancer the surgeon sees have their origin in moles.

Corns are thickened cuticle, the result of *occasional* pressure, whether on the toes or feet, from tight or hard boots; or on the hands, from the mechanical irritation of tools, &c. It should be remembered that they are the result of occasional, and not constant pressure, the latter causing atrophy and absorption. Not only, wrote Hunter, "the cuticle thickens, but the parts underneath, and a sacculus (*bursa*) is often formed at the root of the great toe, between the cutis and ligaments of the joint, to guard the ligaments below." This *bursa* forms under all corns when the pressure is not removed, in all old and neglected cases. A corn, when newly formed, can, by maceration, be elevated from its position as thickened cuticle only, the cutis being unaffected; but in old corns the cutis appears to atrophy, and the papillæ to disappear. Such corns, writes Mr. T. Smith ("*Holmes's Syst.*," vol. v), "may be found based upon the fibrous tissue of the sheaths of the extensor tendons of the toes, all intermediate structures having been absorbed." When a *bursa* has formed it may inflame or suppurate, and give rise to troublesome conditions, such as will be described under "bunion."

A corn is called "soft" when it forms between the toes. It is far more painful and sensitive than the "hard" corn; it grows also more rapidly, these points being probably determined by its greater moisture.

TREATMENT.—Remove the cause and the disease will disappear. This is a truism which applies to corns of all forms, when acted upon early. Boots which are too loose are as injurious as those which are too tight; where one presses the other rubs, and the result is the same. A well-fitting boot, with a straight inner border and broad top, is the best. To remove the cuticle nothing equals warm water; after soaking the part in it for some time, or keeping the corn covered for a night or more with water-dressing and oiled

silk, the whole may be carefully peeled off by means of a knife. After the removal of the corn the skin should be protected by a piece of soap-plaster spread on leather. The application of nitrate of silver has been recommended. I have known it produce great pain, and, when applied to an inflamed corn, much harm; indeed, in one case sloughing of part of the integuments covering the little toe; in old people it is dangerous. The application of the glacial acetic acid is to be preferred. When suppuration takes place beneath a corn it should be relieved by a puncture as soon as possible, and water-dressing applied. Bursal swellings are to be treated as bunions. Soft corns are best treated by taking away pressure by means of the introduction of wool—that directly off the sheep being the best—between the toes, and the use of some dry powder, such as the oxide of zinc; the corn then soon becomes a dry one, and may be eradicated. The acetic acid is a good application in obstinate cases.

Bunions.—When from excessive or long-continued pressure a bursa forms over one of the tarsal or metatarsal articulations, a “bunion” is said to be present; the most common seat being the metatarsal joint of the great or little toe. This fact is to be explained by the evil tendency which boots, as generally made, have to draw the toes together towards the central line of the foot. In this way the central axis of the undeformed great toe is altered from the normal line, which runs parallel with the metatarsal bone, through the centre of the heel, to an abnormal one, in which the great toe itself, looking outwards, forms an angle pointing inwards with the metatarsal bone at the joint, and the axis of the toe falls far within the normal one of the foot.

Aston Key attributed this deformity more to excessive weight received on a weak tarsus and metatarsus from over-standing; the great toe being gradually forced outwards by the oblique bearing of the foot on its inner plantar surface, when the arch of the foot has given and the foot become flat. When the boots are too short a like change occurs; the foot becomes compressed longitudinally; the arch of the tarsus becomes increased; the toes are drawn up, even to form angles with the metatarsal bones, the great toe suffering the most. Protective bursæ form over the projecting bones, to save the joints from injury, and at times over the dorsum itself. Under extreme conditions the bursa may inflame and suppurate, giving rise to obstinate and troublesome sores; in still more extreme or neglected cases the joint of the great toe may be involved, ending in the destruction of the joint, with or without exfoliation of bone.

TREATMENT.—When the nature of a bunion is understood, the principles of its treatment become clear. Preventive treatment is the best, and that consists in maintaining the natural condition of the foot—in young children, and in girls especially, in guarding against the flattening of the foot from over-standing or walking during the period of growth, in guarding against altering the axis of the great toe, by keeping the inner line of the boot straight, and in no way by too short boots cramping the foot longitudinally.

When a bunion exists the only consistent treatment is the one that tends to restore the misplaced toes to their natural position; when the great toe is involved, either by Key's plan of having a separate compartment made in the boot, so constructed as to keep it in a straight line with the foot, or by the bunion spring, as recently invented by Mr. Miller, of Leicester Square. Even in severe cases this practice may be successful, and in the old and confirmed cases the same is to be adopted; palliative treatment at times is alone practicable.

The common plan, wrote Key in 1836 (“Guy's Hosp. Rep.”), “resorted to for the relief of bunion palliates the evil, in some degree, by removing

the pain, and taking off the pressure; but it does not go to the root of the evil. The plasters on thick soft leather are agreeable to a painful bunion by keeping the skin in a pliant state, and by protecting the part from pressure;" but they do not cure the disease.

Under all circumstances pressure is to be removed; nothing like a tight boot is to be thought of, a wide and easy one being worn. To the inflamed bunion water-dressing is the best application. Should suppuration take place, an early incision into the bursa should be made. In old people, however, some caution is called for in carrying out this practice, for in such, where from diseased arteries or other causes the circulation is feeble, gangrene of the part or a troublesome suppuration may take place. When suppurating sores exist, they may in the old require stimulating applications; in the middle-aged, the bursa may be laid open, and allowed to granulate, or be excised. In the early stage of a bunion the mechanical means suggested may be aided by the local application of a small blister, and Mr. Thomas Smith speaks highly of the local use of the biniodide of mercury, ten grains to an ounce. ("Holmes's Syst.," vol. v, 2d ed.)

Ingrown Toe-nail, as it is usually called, is a troublesome and painful affection; it is more commonly met with on the outer side of the great toe-nail than on the inner, but it may occur in both places; it is usually caused by external pressure upon the soft parts, the movable soft parts being pressed upon the immovable nail. As often as not, it is due to the collection of cuticle beneath the edge of the nail, this cuticle acting as a foreign body, and by its pressure causing ulceration. Ulceration having been once set up, the healing process is prevented by the presence of this cuticle, the pressure of the edge of the nail, and the soft parts covering it in. Fungous granulations, consequently, frequently form, and copious discharge takes place, the affection being attended with severe pain.

TREATMENT.—The disease being the result of pressure applied from without, in the shape of tight boots, or from within, in the form of indurated cuticle beneath the nail, the surgeon's main object in the treatment is to take away the exciting cause; and, when the collection of cuticle exists, by the careful introduction of a probe beneath the nail, to procure the evulsion of the foreign body. In early examples of the disease this treatment is often sufficient. When external pressure has been the cause, and ulceration exists, the soft parts may be carefully pressed away from the sharp edge of the nail, against which they are pressed, by carefully introducing beneath the overhanging integument a small roll of lint, pressing it well down to the bottom of the sore, and fixing it in position by means of strapping, which should be so applied as to draw the soft parts away from the nail. This treatment, by removing all pressure from the sore, is, as a rule, successful; when the fungous granulations are excessive, and discharge profuse, the free use of alum, oxide of zinc, lunar caustic, or powdered nitrate of lead before the application of the lint, is of great value. After one or two applications of this lint, &c., the surface of the sore will be visible, the soft parts having been pressed to one side, and the edge of the nail exposed. Under these circumstances the lint, or a piece of thin sheet lead or tin foil, may be carefully introduced beneath the edge of the nail, and the dressings reapplied. Under this treatment a rapid cure readily takes place, and if no external pressure be applied, and the nail is allowed to grow up in its normal square form, no recurrence will occur. In severe cases, where the soft parts so overhang the nail as to be unaffected by the means here suggested, or in which the nail perforates the soft parts (Fig. 211), the best practice is to excise, by means of a scalpel, the overhanging integument. In this way the ulcer is exposed, and all external pressure

at once removed, the sore, as it heals, having a tendency to contract, and thus considerably to diminish the chance of a repetition of the affection.

When the ulcer has spread far under the nail, it may be expedient to remove a portion of it, to allow of its cicatrization; but in a general way, to remove half the nail, to take away a V piece from its centre, to scrape or notch it, are only temporizing measures. They may succeed for a time, and allow the sore to heal, but it will recur, in all its severity, as soon as nature has restored the parts which the surgeon has injured.

To cut the corner off the nail, under the idea that it is the offending body, is a futile proceeding; it may for the moment appear to be of use, but, in the long run, it is injurious; indeed, the nail should be left square, as nature made it, and care should be taken to see that by no external pressure are the soft parts pressed over its edge.

Onychia Maligna is a disease of the nail matrix, and a far more severe and obstinate affection than the last. It is found most commonly in unhealthy children, and is, as a rule, started by some local injury, such as a squeeze. It commences as a swelling of the end of the finger, with the other external signs of inflammation—redness, heat, and pain; these symptoms are soon followed by the exudation of a serous fluid from beneath the nail, which is often fetid; the nail itself loosens, and either flattens out or curls up at its edges (Fig. 212). When this occurs, a foul ulcer is visible

FIG. 211.

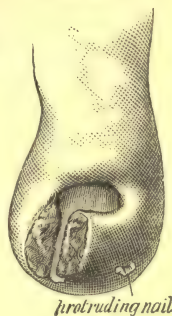
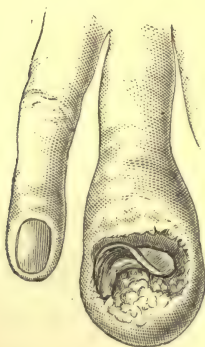
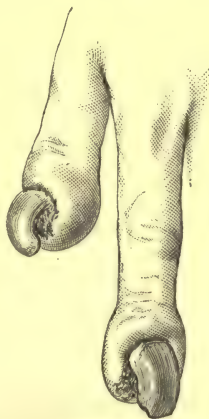


FIG. 212.



Acute onychia.

FIG. 213.



Chronic onychia.

beneath. In extreme cases the finger assumes a flattened bulbous form, and looks as incurable as any local affection can well do, and, in rare instances, the disease involves the last phalangeal joint or bone. It is never found in other than feeble and cachectic children. The worst case I have seen of this disease occurred in a child, æt. 10, in whom the fingers and thumbs of both hands were involved; it had existed for years.

TREATMENT.—In favorable and not extreme examples of this affection tonics internally and water-dressing externally suffice to bring about a cure; but in others more active local treatment is called for, such as the application of some mercurial lotion, as black-wash, or Abernethy's lotion formed

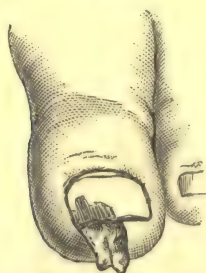
of the liquor potassæ arsenitis ʒij to ʒj of water, or the red oxide of mercury ointment. In the case I have just alluded to all this treatment failed, even after the evulsion of the nails—a plan of treatment that should always be adopted in obstinate cases—and a cure was at last secured by making a clean shave of the dorsal aspect of the extreme phalanx, taking away nail and soft parts. This practice was adopted only after the disease had existed for five or six years, and had resisted every form of treatment, even the repeated evulsion of the nails; the pain being agonizing and demanding surgical interference. Fig. 213 was taken from one of the fingers of this patient. Constitutional treatment is always needed, with tonic regimen.

This disease is said at times to have a syphilitic origin. I have been unable to satisfy myself as to the truth of this point. When associated with other symptoms of syphilis, however, it will be wise to adopt specific treatment.

Other Diseases of the Nails.—Under the influence of some acute diseases the nails cease to grow, and the arrest becomes manifest, as convalescence appears, by a transverse groove, which represents the period of arrest of growth, while its width denotes the duration. As a result of hereditary syphilis Mr. Hutchinson has shown that the nails may become completely ridged, and even in acquired syphilis, Hutchinson, Wilks, and Fagge have fairly proved that the nails may become narrow, thick, ill-formed bodies, or concave, rough, and black.

Psoriasis affects the nails somewhat in the same way, the nail thickening and splitting vertically, and in *favus*, Fagge has shown that the part may become thickened, and of a yellow color, from the interstitial deposit of the parasitic disease. Wilks, in the "Lancet" for 1868, and Fagge, in "Guy's Hosp. Rep.," 1869-70, wrote fully on these points. At times the nails be-

FIG. 214.



Horny growth from beneath nail.

FIG. 215.



Ungual exostosis.

come soft and, in feeble subjects, very convex. This condition is said to be common in phthisical subjects, but in surgical disease I have often observed the same condition to appear during illness, and disappear as strength returned. I look upon it only as a mark of feeble power.

Horny Growths occasionally spring up beneath the nail, as seen in Fig. 214, and *ungual exostosis* very frequently appears—that is, a bony outgrowth from the extreme phalanx of the great toe, as seen in Fig. 215. Both require excision.

CHAPTER XLI.

ABSCESS, FISTULA, SINUS, ULCERS, GANGRENE, HOSPITAL GANGRENE.

WHATEVER may be the origin of pus, whether degenerated lymph, new cell growth, the result of inflammation of areolar tissue, or escaped white blood-corpuscles, points discussed in Chapter I, a *circumscribed* collection of pus in any tissue is called an "*abscess*." When pus *infiltrates* a part, and is not circumscribed, *diffused suppuration* is said to exist; it is a severe disease, always indicative of want of power.

An abscess that forms rapidly and is associated with severe inflammatory symptoms is known as an "*acute abscess*;" another, the result of a chronic action and of slow formation, as "*chronic or cold abscess*," but there are many intermediate forms.

Pus may, however, be absorbed, the serous fluid in which the cells float being taken up, and the cells left to wither, these cells subsequently forming a pultaceous, and, at a later date, a cretaceous mass. Clinically, however, pus may disappear altogether, and leave no external evidence of its former existence. This fact is now clearly recognized by surgeons; it is constantly seen, and is often watched in the disappearance of periosteal enlargements, chronic subcutaneous abscesses, and in the eye in hypopion.

Pus varies much in its character; it is often thin and watery, this condition being generally indicative of want of power. It is then called "puriform fluid," the pus cells being ill formed. When it is bloodstained, it is called "sanious;" when thin and acrid, "ichorous;" when it contains flakes of curdy lymph, "curdy." Bransby Cooper showed that pus from bone contains granular phosphate of lime, and Sir D. Gibb has collected sufficient evidence to prove that the presence of cyanurate of iron may give a bluish tint to pus. Pus from the brain is often green, from the liver brown, the débris of broken-down tissue in different proportions and kinds giving these characters.

The walls of an abscess are made up of organized fibrinous exudation, this exudation being a means of nature's adoption to arrest the extension of the disease; around the wall the parts are always œdematous from serous effusion, as indicated by pitting on pressure. This fibrinous exudation forms what the surgeons of old called the pyogenic membrane.

An Acute Abscess comes on with severe constitutional disturbance, fever, and sharp local pain, accompanied with the usual phenomena of inflammation, redness, heat, and swelling. As the abscess forms these local symptoms become intensified, and perhaps concentrated; the pain alters in character, it becomes at first dull and heavy, and then throbbing; the fever symptoms also subside, or rather intermit, a shivering fit or rigor, more or less well marked, followed by heat, and possibly sweating, taking its place. The swelling that was previously diffused becomes more localized; the parts covering it in begin to thin, and with the fingers of one hand steadily kept flat upon the swelling, and those of the other made to press upon it at another part, the walls of the abscess will be made to bulge against the fixed fingers, and a sense of "fluctuation" be given, this feeling of fluctuation indicating the presence of fluid, and in this case of pus. If the case be left to nature, this thinning of the parts covering in the abscess will continue in the direction of least resistance, and when in the soft parts, towards the surface; the skin will either slough or ulcerate, and the abscess burst, discharging its contents. The pus having been evacuated, the walls of the

abscess by their natural elasticity will fall together or collapse, the external wound close, and the whole heal or contract into a *sinus* or narrow canal, also called a *fistula*. When, however, the pus is *deepseated*, bound down by fascia or periosteum, what is called "*burrowing*" takes place; the matter makes its way between the soft parts, where the least resistance is met with, and opens either into a mucous passage, serous cavity, or joint. Abscesses beneath the periosteum constantly open into joints; abscess beneath the abdominal muscles, or within the abdomen, into the intestinal canal; abscesses beneath the deep fasciæ of the neck open into the pleura; and in the extremities, they burrow beneath the muscles, and make their way to the surface a long way from the original seat of the disease. Thus, in disease of the dorsal vertebræ an abscess may burrow beneath the abdominal fascia, behind the sheath of the psoas muscle, Poupart's ligament, deep fascia of the thigh, and open on the inside or outside of the thigh; in other cases it may pass into the pelvis, and out again at the sciatic notch, and appear in the buttock as a "gluteal abscess."

In disease of the lumbar vertebræ an abscess may form, and burrow between the abdominal muscles, and appear in front of the abdomen above Poupart's ligament. An abscess beneath the scalp may undermine the whole scalp tissue; one behind the fascia and muscles of the pharynx spread so as to cause a large post-pharyngeal tumor, and suffocate mechanically by its presence; deep-seated abscesses of the neck may burrow into the thorax, and produce fatal mischief; but these instances are ample to show how pus, when confined beneath a strong membrane, will burrow along the cellular tissue of a part to find some external outlet, and how necessary it is for the surgeon to be aware of the fact, in order that he may stop the process, or, as far as it lies in his power, prevent any harm following the act, or trace the cause of the disease back to its source, and find out its origin.

Acute abscess in bone is attended with severe local symptoms and constitutional distress.

Some *chronic abscesses* are of remarkably slow formation; they give rise to very little constitutional disturbance or local distress; indeed, except mechanically, they seem to be of little annoyance—unless they are secondary to some organic disease, and even then it is astonishing to what a size a chronic abscess will sometimes attain before it is discovered or complained of. In spinal cases this is often verified. In children, also, large abscesses form in the same quiet way; they are, however, never met with in the robust and strong. Abscesses connected with enlarged glands are peculiarly passive in their progress, and appear to cause pain only when they begin to make their way through the skin. The abscesses about joints, that appear during the convalescing period of the affection, when the joint disease seems to be undergoing recovery, show themselves in the same quiet way; they seem to be a simple breaking-down of old inflammatory products that were poured out in the cellular tissue during the more active period of the disease, and that had failed to be reabsorbed or to organize. They constantly undergo absorption, and should not be rashly interfered with.

This question, therefore, leads to that of *treatment*; and it may safely be said that, wherever burrowing suppuration can be made out to exist in a part, the sooner an external outlet is made the better, whether that burrowing be beneath the scalp, behind the pharynx, amongst the deep cervical tissues, in the thecæ of tendons, between the layers of muscles of an extremity, or beneath the periosteum of bones,—particularly about joints or anywhere beneath the deep fascia, especially of the perinæum and anus.

Superficial abscesses should always be opened, a lancet, or a fine double-edged knife, being employed. On the neck and face the line of incision should be made to correspond with the course of the superficial skin muscles, or the lines or folds of the part; in this way the deformity resulting from the cicatrix is greatly diminished; but in other cases the incision must be in the best direction for emptying the cavity. In all abscesses the point of puncture should be made where the abscess is "pointing," or integument thinnest; and, where this indication is absent, at the most dependent part of the abscess. The operator should always avoid dividing superficial veins and nerves, the position of the former being made out by intercepting the flow of blood through them by the pressure of the finger.

Deep vessels and nerves should be carefully avoided, their anatomical position being always recalled to mind; when abscesses have to be opened in their neighborhood, the incision should be made parallel to them.

In opening an abscess, no plunge is to be made; the operator is to take his instrument, and, having marked the point of puncture with his eye, introduce it with decision through the soft parts into its cavity, and, as soon as pus oozes upwards by the side of the instrument, the incision is to be made of the required length by cutting outwards.

To do this act sleepily is to give unnecessary pain; to do it with a stab or plunge, to cause unnecessary alarm. It is to be done as every other act of surgery, with confidence and decision: boldness and rapidity of action being governed by caution, and made subservient to safety.

To open an abscess that is pointing, or that has a cavity which is to be felt, and is not covered by parts that it would be dangerous to wound, by cutting down upon it, as if dissecting, is a *bad* practice; although in deep-seated abscesses, where surgical interference is called for, and in which it is dangerous to introduce a knife through any thickness of tissue, such a method may be the best—extreme caution being justified under extreme danger. It is under these circumstances that what is known outside Guy's Hospital as Mr. Hilton's method of opening deep-seated abscesses is so good. The practice has been followed at Guy's for many years, and was first publicly explained by Mr. Hilton in his excellent "Lectures on Rest," 1863.

"In deep-seated abscesses in the axilla," says Hilton, "I cut with a lancet through the skin and cellular tissue of the axilla, about half or three quarters of an inch behind the axillary edge of the great pectoral muscle. At this point we can meet with no bloodvessels. Then I push a grooved probe, or grooved director, upwards into the swelling in the axilla; and, if you watch the groove, a little opaque serum or pus will show itself. Take a blunt (not a sharp) instrument, such as a pair of dressing forceps, and run the closed blades along the groove in the probe or director into the swelling. Now, opening the handles, you at the same time open the blades, situated within the abscess, and so tear open the abscess. Lastly, by keeping open the blades of the forceps during the withdrawal of the instrument, you leave a lacerated track or canal communicating with the collection of pus, which will not readily unite, and will permit the easy exit of matter." In this way deep cervical and post-pharyngeal abscesses, deep abscesses of the thigh and leg and forearm, may be fearlessly opened.

When an abscess has been opened it should be left to discharge by itself, a simple poultice or warm-water dressing being applied over the surface. No squeezing or pressing the walls of the abscess is wanted; such means are both unnecessary and injurious. In some abscesses it is well for a few hours to leave a piece of lint covered with oil between the edges of the

wound, to prevent its closure, but this is not necessary in all, it is only when the deep fascia has been opened.

Tonics and good feeding are always essential elements in the treatment, sedatives being given only when required.

During the formation of an abscess fomentations, poultices, and warm-water dressings give comfort, and may be used; they are only admissible, however, when suppuration and external discharge is looked for. When absorption is probable such means should not be employed; this result can, however, only be expected in chronic abscesses, and where such exist, and are not connected with deep-seated mischief, their disappearance by absorption is a practical and reasonable hope. The local affection then requires no other treatment than rest and an absence of all irritating applications, tonic treatment and regimen being the main means upon which reliance can be placed.

On many occasions in children I have drawn off the pus from a chronic abscess with the aspirator (*vide* Fig. 160, p. 300), and no re-collection has taken place, but a disappearance of what was left; as often as not, however, the fluid reaccumulated, and a free incision was subsequently required. Whenever an abscess is opened the incision should be free enough to admit of a ready outlet of its contents, and to forbid its reaccumulation.

In acute abscesses about the hand or foot an opening cannot be made too early; that is, when effusion has taken place, and the soft parts are tense. Under these circumstances an early incision will often save tissue, and the student must not think he has done wrong when on making the incision he finds no pus exude.

To arrest acute inflammation in a limb the deligation of the main artery of the limb, or the arrest of the circulation through it by pressure upon the artery, has been adopted. Dr. Campbell, of New Orleans, speaks highly of the practice, and even affirms that no portion of an extremity should be amputated for destructive inflammation without the surgeon attempting the practice. On the suggestion of Mr. Maunder, of the London Hospital, in 1867, Mr. Little applied a ligature to the femoral artery for acute suppuration of the knee, with a success sufficient to prove its value; and the late Mr. Moore, of the Middlesex Hospital, acupressed the brachial artery with a good result. Previous to these cases, however, as early as 1813, Dr. Onderdant, of America, ligatured the femoral in a case of wound of the knee-joint, to check acute inflammation, and other surgeons since his time have followed his practice. It is a method of treatment certainly worthy of attention, for to cut off the supply of blood to an inflamed part, when too much exists, is a sound theory, and to do the same to starve a disease is equally scientific. In elephantiasis arabum the practice does not seem to be without its good effects, and in acute disease it is admissible.

I well remember, as a student, watching a case that was under the care of Mr. Bransby Cooper, in which a bad compound fracture of the leg existed, with a severe laceration of the thigh of the same side, and division of the femoral artery. Mr. Cooper was in doubt as to the practice to be followed, whether with the divided femoral the supply of blood would be sufficient to repair the compound fracture, but the case proved that the doubt was a groundless one; repair went on uninterruptedly well, and a good limb was the result; the patient was a man of middle age.

With respect to the treatment of inflammation by the *digital* compression of the main arterial trunks leading to the injured or diseased parts, it must be recorded that in 1861 Dr. T. Vanzetti, of Padua, wrote a paper upon it, which Mr. S. Gamgee has recently translated in his work "On Fractures," 1871. He was led to apply this treatment to cases of inflammatory

disease from its success in the treatment of aneurisms. He writes that compression will cure every incipient inflammation, and check it even when advanced. He gives cases of phlegmonous erysipelas and acute arthritis of hand successfully treated by these means. He adds, however, that "in the treatment of aneurisms as of inflammations compression can never become a normal method until it be always and exclusively effected with the finger."

When chronic abscesses require opening, a practice that is not always to be followed, the adoption of Mr. Lister's plan of covering the opening with a piece of lint soaked in carbolic oil, to prevent the possible admission of air or any septic matter, seems certainly a good one. Whatever the theory of its goodness may be, the practice is worthy of adoption. I have treated a case of abscess filling the left loin and abdomen as far as the median line, and showing below Poupart's ligament, in a young lady æt. 18, by these means, and evacuated quarts of pus, the whole closing within a month, or rather degenerating into a small sinus that discharged serum for three or four weeks, and then closed without the slightest constitutional disturbance. The origin of the abscess was very obscure. I have treated likewise a spinal psoas abscess, a large one of the thigh, and another of the loin, with equal success; a fifth also, clearly renal in its origin, might be recorded to support the practice.

The practice consists of a free opening into the abscess, and, as the pus flows, the application of a piece of lint soaked in carbolic oil, one part of acid to twenty of olive oil, care being observed in the dressing that no air be admitted into the abscess unless charged with the vapor of the acid. The lint should only be removed to be replaced by a freshly steeped piece, and no pressure made upon the walls of the abscess to empty its cavity without the opening being covered with carbolic oil. I have used, in several cases, olive oil alone with an equally good result. With the same view of excluding air and its impurities, the use of the trocar and canula has been suggested, a valvular skin opening being secured by drawing the integument to one side before making the puncture. The trocar invented by Mr. Thompson, of Westerham, is also good; in it an elastic tube is fitted to a second mouth below the instrument. But beyond any of these in their usefulness, when such a practice is wanted, the "aspirator" is to be recommended. By it the contents of any cavity can readily be *explored* or withdrawn without a possibility of the entrance of air; but, as a rule, where an abscess wants opening, a *free* opening is desirable, care being taken that, where air enters, its exit can be guaranteed, the cavity being washed out freely as often as occasion calls for it. In this way suppurating ovarian and hydatid cysts may be treated as large abscesses, and with good success. Empyemas or abscesses in the chest can be treated on the same principle, a free opening into the thorax and a free outlet for the pus. The drainage-tube in these cases is of great value, allowing it to drop well down to the bottom of the cavity. I have had four or five cases in which this practice was followed with good success.

The drainage-tube was suggested by M. Chassaignac; it is simply a small india-rubber tube, perforated every inch or so with small holes, to allow of the free escape of the pus. When used in large cavities, the cavity should be washed out, with or without Condry's fluid, at intervals; nothing like decomposition, as indicated by fetor, should be allowed. With this precaution large cavities can be dealt with successfully.

When veins and large arteries open, by ulceration, into abscesses—an accident of occasional occurrence—they must be dealt with on the principle laid down in the chapter on hemorrhage.

In opening an abscess to relieve pain, the ether spray is a valuable agent.

The chronic abscesses associated with glandular enlargement need not be opened under all circumstances, for with constitutional treatment they often disappear. They should not, however, be left to nature to open, as ugly cicatrices will be caused by ulceration of the skin; but as soon as it is clear that they will open by natural processes, the surgeon should interfere, making a small puncture in the best line to allow of the exit of the pus and to prevent disfigurement. Gentle pressure with cotton-wool over the part afterwards often hastens the recovery. In subjects of the hemorrhagic diathesis an abscess may be opened by the moxa or canula.

Sinus and Fistula.—A *fistula* is an unnatural communication between a normal cavity or canal and the outside of the body or second cavity or canal.

A *sinus* is a narrow suppurating track with only one orifice.

Both will here be considered together. Thus, amongst the *fistulæ*, there are the vesico-vaginal and recto-vaginal *fistulæ* in women; the recto-vesical in men; fecal *fistulæ*, gastric and biliary *fistulæ*, and *fistula*, salivary *fistula*, urinary *fistula*; they are always due to some suppurative or ulcerative process, or mechanical violence, operative or otherwise, and to a want of repair subsequently. When passages are close together, the *fistula* will be a short direct one; in some large, in others narrow or tortuous. When the cavity or canal is deeply placed, or the inner opening of the *fistula* deeply situated, the *fistula* may be a long narrow track. When the *fistula* is of recent origin, the walls will be soft, as of granulations discharging *pus*, readily bleeding on manipulation. When *old* they will be smooth and hard, "callous" all over, and non-sensitive, secreting a thin, watery, non-purulent fluid. This fluid will, moreover, be mixed with the contents of the cavity or track with which the *fistula* communicates, this discharge tending to keep the *fistula* open.

The *external* opening of a *fistula* or *sinus* presents very different appearances; it may appear as a direct opening, a valvular opening, a depressed or raised one; when leading down to a foreign body or bone, the external orifice will be surrounded by weak granulations. Sometimes it may scab over for a time, and then reopen by the force of the retained fluid.

The *internal* opening of a *fistula* mostly appears as a defined orifice.

Of *sinuses* or incomplete *fistulæ*, abscess is the most common cause; the external communication failing to heal from some defect in the healing power of the part; from some interference with the reparative process; from the constant discharge of *pus*, which has not a sufficiently free vent; or from muscular action, which forbids that amount of rest of the part required for its repair; or lastly, from the presence of some foreign body introduced from without, from dead bone or cretaceous inflammatory product from within.

The **TREATMENT** of the different forms of *fistulæ* is given in the chapters devoted to the special organs that are involved. In a general way, however, it may be said that as long as the cause of the *fistula* exists repair cannot go on; that is, in urinary *fistula*, when stricture is the cause, the stricture must be treated before the *fistula*.

In anal *fistula*, when the action of the sphincter ani forbids repair, its action must be paralyzed. In fecal *fistula*, when obstruction to the bowel is present, the obstruction must be removed. In salivary *fistula*, the salivary duct must find a natural outlet before its unnatural orifice can be expected to close. When any foreign body, tooth or dead bone, is present, keeping the *sinus* open, it must be removed. When a suppurating cavity

at one end of the fistula keeps on discharging, means must be taken to close it, and so on. When these objects have been achieved the attention of the surgeon may be directed to the fistula or sinus itself, and various are the means that have been employed.

Pressure in recent sinuses, to keep the parts in apposition, by pads, strapping, or bandages, is sometimes of use, the muscles that move the part being kept absolutely at rest. In stumps, and after mammary abscesses, this practice is very good.

Injection of some stimulating fluid, such as the preparations of iodine, either as the compound tincture or that diluted with one or two parts of water, will sometimes set up a more healthy action; for the same purpose a *seton* has been used, but of all setons the small *drainage-tube* is the best, or a narrow coil of rolled gutta-percha skin. I like this better than Ellis's spiral wire drainage-tubes, although they are good. The *cautery* is often of great use, and the galvanic is its best form; it can be so accurately applied to the exact spot, and its heat can be maintained; it is only good, however, in small fistulæ.

Laying open the sinus is, however, as a rule, the best plan, dividing it from end to end, and keeping the sides asunder to allow of its healing upwards. This may often be done with striking advantage with the wire of the galvanic cautery. When done with a knife, the incision is to be made upon a grooved probe or director, previously introduced through the sinus. When the cautery is used, the wire should be passed through the sinus on the grooved director, or threaded in an eye probe, the surgeon holding the two ends of the wire, made hot by contact with the battery, and dividing the tissues with a sawing motion.

The division with the cautery has this advantage, that the surface of the sinus is so destroyed that it must granulate; there is consequently less need of careful dressing. In old sinuses this is another point, for their surfaces are so callous that they require to be scraped or otherwise rendered raw to permit of granulations forming.

The division of a fistula with the ligature is now rarely done; in "bleeders" it might be called for, but in these the galvanic cautery is preferable when it can be obtained.

Plastic operations are also means of great value, applicable to certain cases, particularly to vaginal and rectal fistulæ. They will be discussed in another chapter.

Last, but not least, in the treatment of sinuses and fistulæ constitutional treatment is to be employed. In the fistula following operative or suppurative action it is, as a rule, all that is wanted, and many are the cases in metropolitan hospitals of sinuses about stumps, skin wounds, or mammary wounds, that heal rapidly under the influence of fresh air, good food, and tonic medicine.

In all cases these means are most essential, and with them and local treatment success is generally to be secured.

CHAPTER XLII.

ULCERS OR SORES.

Ulceration is an inflammatory process, in which a *sore* or *chasm* is produced by the molecular death of the tissue.

A **Sore** is a chasm, a solution of continuity, caused by ulceration upon an external or internal surface of the body.

When a *sore* is being formed, or is spreading by the process of ulceration, an *ulcer* is said to exist; when the ulceration has ceased, a *sore* remains.

When an *ulcer* spreads slowly it is called a spreading ulcer; when it spreads rapidly by ulceration, it is termed *phagedænic*; when the ulceration destroys tissues by gangrene of the parts the ulcer is said to be *sloughing*; and when with this more general gangrene, the molecular death, or gangrene of the tissue, or ulceration, is combined, *sloughing phagedænic* ulceration is said to exist.

All these processes are consequently different forms of spreading ulcers, and are characterized by the degrees of rapidity of the process, the simple ulcer being the mildest form, the sloughing phagedænic the most severe.

A **healing ulcer** or **sore** heals by the same process as any open wound, the result of injury or operation, does, by *granulation* and *cicatrization*. Sores may be *healthy*, *inflamed*, *weak*, *indolent*, *sloughing from excess of indolence*, or *irritable*, terms which are applied to sores to express their conditions at the time, but having no special signification, for these appearances fluctuate according to the general condition of the patient and the local treatment of the sore.

A **sore** may at any time take on the ulcerative process and spread, assuming any of the forms of spreading ulcers already given.

An **ulcer** may originate from a *local* or *constitutional* cause.

Amongst the *local causes* are injuries produced by blows, pressure, or some irritating application, some skin eruption, or something that sets up or is followed by inflammation, and subsequent ulceration. A piece of skin dies, it is cast off by ulceration; a portion of integument inflames from some external irritation, or a local eczema or skin eruption, and an ulcer results.

An abscess forms beneath the skin or in the deep parts, and bursts by ulceration. It may be that some deepseated disease was the cause of the abscess; the ulceration spreads and remains as an ulcer.

Amongst the *constitutional causes*, *excluding cancers*, may be classed anything that induces a low condition of the vital powers, such as any illness or certain habits of life, syphilis, or scurvy.

It should be remembered, however, that ulcers that have a constitutional origin may be kept up by local causes; a syphilitic ulcer or cachectic ulcer originating from a general cause may take on any of the characters common to the healing ulcer or sore. A local ulcer or sore, produced from local causes, may fail to heal from some constitutional defect.

Lupus, rodent ulcer, epithelial or carcinomatous ulcers, stand by themselves; they are *special* ulcers.

There are, then, **local** sores originating from local causes, that are often kept from healing through some general or constitutional failing; **constitutional** sores originating from constitutional causes, that may fail to heal on account of some local condition interfering with repair; and **special**

sores; and for their treatment it is most essential that the three different forms be recognized.

Local Sores, as already stated, have a local origin; something sets up inflammation and ulceration in the skin, and a sore remains; the disease is cutaneous from the first. The few cases connected with disease of the deep-seated parts, such as the bones and joints, can readily be made out.

Constitutional Sores have rarely a cutaneous origin, unless originating in some ulcerating skin eruption, such as ecthyma or rupia; but they almost always commence in the cellular tissue as a more or less circumscribed induration, which lasts a very variable period, and then softens down, the skin over it inflaming, sloughing, and ulcerating, to give vent to a slough of cellular tissue, and the ulcers always being of a *cellular membranous kind*. These ulcers may have their cause in an ordinary cachexia or in syphilis, but the cellular membranous ulcer is always constitutional, and requires general more than local treatment. In syphilis they are the result of broken-down subcutaneous "gummata."

The appearance of these sores will depend much upon the period at which they are seen, but, following them up from the time when the skin has broken and ulcerated to give vent to the sloughing cellular tissue, the margins of the skin opening will appear thin, irregular, and undermined; at the bottom of the opening the slough will show, and when non-syphilitic it will appear more or less white, sometimes pearly; but when syphilitic it will have the aspect of a *piece of wet wash leather*, at least in the majority of cases. When the slough has come away the skin will at first be undermined, and the margin of the sore fall inwards, but as the granulations rise from below, the skin will be pressed up, although when the wound has cicatrized the scar will almost always be a depressed one, and in syphilis stained.

Around this sore several small openings often coexist, each one having formed to give exit to a small slough, the margins being cut as if punched. These sores mostly occur about the lower part of the thigh and knee, elbow, shoulder, and forehead; they are found, however, in any part of the body. The syphilitic are always surrounded by a *dusky* kind of inflammatory border, and are rarely painful; the non-syphilitic with a pinker blush. The wash-leather slough and dusky margin fairly indicate the syphilitic sore.

The special sores will be described with the diseases from which they result.

A healthy, healing, Cutaneous Sore is known by the small, florid, conical granulations that cover its surface, and the healthy creamy pus that they throw off. The granulations are not so vascular as to bleed, or so sensitive as to cause pain on the slightest touch. Its margin is natural, and where the skin and granulations meet a band of cicatrizing tissue is to be seen, this band assuming, where in union with the skin, a whitish line with a fine covering of epidermis; where in contact with the granulations a more vascular appearance than at any other part of the sore, the centre of the band being covered with a thin, purplish-blue, semi-transparent film.

By the gradual cicatrizing process of the outer border of the band inwards, and the gradual narrowing of its circle, the sore heals, the surgeon's sole aim in its treatment being to guard it from anything that can interfere with the progress of repair.

The *treatment* is, therefore, simple, a piece of wet lint to absorb discharge and protect its surface from injury being all that is usually called for, and the lint being kept moist by a piece of oil silk, gutta-percha, or elastic tissue. Where water irritates, oil may be substituted. The surface of the sore should be cleansed, by means of a stream of tepid water; sponges

should not be used. Cotton-wool is the best substitute, and it can be destroyed after use.

Where the granulations are disposed to rise too high, dry lint may be applied, and at times a good rub with lunar caustic hastens recovery. Small sores thus treated may be allowed to scab. Rest is always beneficial to aid repair, but should this be impracticable a good bandage should be substituted, a piece of thin sheet lead bound over the sore and its dressing giving good support. In removing the dressing care should be observed not to injure the band of delicate cicatrizing tissue.

Accepting the description given as a type of a healing sore, deviations from this type constitute the different forms that have been described. Thus, when the granulations assume a large, pale, elevated, watery appearance, the sore is said to be a weak one, the granulations in popular language being "proud flesh," the popular word *proud* being synonymous with *weak*. There is power in the sore to granulate, but the granulations have little power of cicatrizing; they are disposed, moreover, to slough on the slightest cause. These sores require local stimulants, such as the nitrate of silver in stick, and dry lint, sulphate of zinc or copper lotion, in the proportion of two grains to the ounce, or carbolic acid lotion of the same strength. Dusting the surface with powdered alum or tannin is sometimes of use, the limb being carefully elevated or bandaged, and the general health attended to.

When there is still less power in the sore no granulations form, the surface puts on the appearance of a piece of mucous membrane, such as that of the pharynx, and the sore is then called *indolent*. At times a few weak granulations crop up at one corner of its surface, but the greater part has a smooth and glassy aspect, and the secretion from it is thin and watery, not purulent. Where the sore has existed long the edges will be raised and indolent, covered with a layer of epithelium, and very senseless, thus acquiring the term "*callous*," a callous sore being an indolent one of long standing.

This indolent sore is always ready to take on a sloughing action on any slight cause, such as some general derangement of the health, or the long assumption of the dependent position of the limb. It is common, indeed, to find the surface of the indolent sore *sloughing*; not, however, from inflammatory action, but from *excess of indolence in the granulating force*. Under these circumstances the surface of the sore becomes covered with a greenish secretion, often fetid, the granulations forming partially, and then dying. When the sore is large this appearance is very common towards the centre, or the lowest part of the sore; and as repair goes on, the sore may cicatrize at its edges, where the granulations derive the full benefit of the vascular and nerve supply, the centre of the sore still sloughing. In old people the margin of the sore may slough in one part and heal in another. Authors have described this indolent sore in the old as *senile ulcer*. These sores are very common; they are usually found in the lower extremities, and often associated with varicose veins; this condition of veins having little to do with their origin, although much with retarding their recovery. They have been described by old authors as *varicose ulcers*, simply from the fact of the two conditions being often found together.

These are almost always found in feeble subjects, with a feeble circulation.

The treatment of these indolent sores consists in encouraging the venous circulation of the part by position if possible, and by pressure where rest cannot be secured; by local stimulants, and general tonic treatment. When there is little or no action in the sore, the application of a blister to the surface is very valuable; and it may be repeated if a sufficient stimulat-

ing effect is not produced, or blistering liquid may be painted over its edges. When the surface is sloughing, from excess of indolence, half an ounce of carbolic acid to a pint of olive oil, with or without the extract of opium, according to the amount of pain, is a capital application, or any other stimulating solution. Where the edges of the sore are indurated and callous, so that cicatrization and contraction is almost impossible, the free scarification of the margin every half inch is often followed by a rapid change for the better; or two free incisions may be made on either side of the margin of the sore for the same purpose; and during this treatment, when the leg can be raised higher than the hip, the venous circulation being thus assisted, the utmost good may be obtained. When rest cannot be observed, the limb may be strapped up from the toes to the knee—omitting the sore—firm pressure being applied by means of a bandage over the dressings covered with a piece of sheet-lead. In private practice, when the leg can be dressed daily, the whole limb may be covered with the strapping. The strapping, however, must be good, not thin, sleazy stuff, such as that sold spread on calico, or thick felt strapping, but that spread on linen, such as is sold by Messrs. Gerrard & Co.,¹ and used at Guy's Hospital.

Where the sore is painful, or the patient has an irritable pulse, the effects of opium twice a day in a pill, with tonics, are very marked; quinine, iron, nux vomica, or the vegetable bitters, may be given, as the wants of the case indicate. The bowels also require attention; drachm doses of the sulphate of magnesia, with quinine, being the best aperient. When the sore is a very large one, and there is little probability of the whole healing, from inability on the part of the skin to allow of its edges being drawn together, fresh centres of cutification should be inserted by transplantation; in this way I have got a large sore of twenty-four years' standing to cicatrize in three weeks, and many others of small size in an equally short period. How far this practice of skin-grafting will do away with the necessity of amputation, in the most severe form of this affection, is a question that has yet to be proved; but hitherto, indolent ulcers that surround a limb have always proved themselves incurable, and amputation has been their only remedy. The surgeon, in amputations, must be mindful to cut through healthy tissue.

All sores may inflame or become irritable, but there is an *inflamed sore* or *ulcer* that is found in subjects who are in some way reduced in power, or "out of sorts," either from irregular living, over-work, or bad feeding. It may be that a blow or graze started the sore, or a local patch of eczematous inflammation—*eczematous ulcer*—but, at any rate, a small superficial, inflamed, irritable sore is produced, that has a raw-looking, inflamed appearance, with an ash-colored slough, or thick secretion over its surface; it will discharge a thin, ichorous fluid, sometimes tinged with blood. The patient will complain of its excessive painfulness, particularly at night, and will dread its being touched; it will look red and angry, yet superficial. The subjects of this sore have generally thin, fair skins; and where eczema is its cause, other patches will often be found around it.

The *treatment* of these sores is very troublesome, the skin being usually highly sensitive; they always want soothing, and the best lotion is one of lead mixed with the extract of opium; sometimes this irritates, and the lead or zinc ointment gives comfort; at other times a cold bread poultice is the best application.

In all cases the limb wants rest and elevation; plasters will not be tolerated. In the eczematous sore, where the discharge from the eruption

¹ 11 Elizabeth Terrace, Islington.

round the sore is profuse, the powdered oxide of zinc and starch, in equal proportions, may be used; or the surface washed with a solution of nitrate of silver, in the proportion of ten grains to the ounce; at times, a solution of the extract of opium is the best lotion. The general health mostly requires tonics of a non-stimulating kind, such as the vegetable bitters with alkalies, the intestines being generally irritable; simple nutritious food, with a moderate allowance of stimulants, must be given, but all high feeding is bad. When pain is severe, opiates and sedatives are indicated. In very inflamed sores, the application of a few leeches, at some distance from the sore, at times gives relief. These sores are always obstinate.

Authors describe a *varicose ulcer*, but it is a great question whether such a special ulcer exists. Many indolent sores are doubtless associated with varicose veins, and are probably indolent on account of this association; but how far they are really caused by them is a different thing, for varicose veins and ulcers of all kinds are constantly met with together, and it would be as just to describe all as varicose ulcers as any single one. Of all ulcers that might rightly claim the term varicose, the eczematous one has probably the most claim, for certainly eczema of the leg is a common consequence of varicose veins, and an eczematous ulcer a result.

Practically, however, it is right to remember, that when varicose veins exist with an ulcer, repair cannot go on favorably unless the venous circulation of the limb be assisted by position or pressure; and that where these varicose veins are present, all ulcers or sores are disposed to become indolent if neglected. When an ulcer takes its origin from an inflamed vein the term is, in a measure, applicable, but this ulcer has no special characters.

To treat the sores that are prevented from healing by varicose veins, the elevated position of the limb, bandaging, or strapping, and in bad cases the obliteration of the veins by such means as have been discussed in page 229, are essential elements of success. Without such the treatment of the sore will, of necessity, fail; with it the sore may be expected to heal with the use of such general and local means as its nature may require.

How far it is right to heal an old chronic sore is not quite decided. The older surgeons used to say it was inexpedient to do so, as cases were met with in which apoplexy or some other alarming condition was apt to follow. But modern surgeons are disposed to question the explanation of these facts, and to look upon that practice as a good one which gets rid of any abnormal condition, local or general. Still, it is wise, when a man has been in the habit of losing by discharge from the surface of a sore a certain amount of material that would otherwise have been used to maintain the general powers, to cut off the supplies in another way, and to order more abstemious living; regulating the bowels by some saline water, natural or artificial, as may suit the stomach.

Sloughing and Phagedænic Sores are rarely seen, except in connection with syphilis or hospital gangrene. In syphilis sloughing is found in the intemperate and ill-fed, and mostly in gin-drinking prostitutes. It attacks any surface that has been made sore, either from venereal contact or other cause; it is marked by the rapid way in which the process destroys tissues, the fetid character of the discharge, the great depression of power invariably present, and the constitutional disturbance.

For TREATMENT it requires, opium in full doses, tonics, and good nutritious food. When this does not control the ulceration, the application of the strong nitric acid to the surface of the sore with a piece of wood is often useful; sometimes the local application of iodine or bromine in solution is of great benefit. Fresh air is always indicated, and plenty of disinfectants, such as Condy's fluid, or carbolic acid in some of its forms. These sores

are mostly due to some feeble constitutional condition, not to a local cause, although at times the local action seems to continue by itself, and requires some powerful escharotic, such as nitric acid, to check its course.

Sir J. Paget describes *cold ulcers*: "They are like small inflammatory ulcers, occurring spontaneously in the extremities, especially at the ends of the fingers or toes, or at the roots of the nails. In some cases they are preceded by severe pain and small gangrenous spots. They are, in many respects, like ulcerated chilblains, but they occur without any exposure to intense cold in patients whose feet and hands are commonly, or even habitually, but little warmer than the atmosphere they live in. Such patients are among those who say they are never warm, and the skin of their extremities, unless artificially heated, is to the touch like the surface of a cold-blooded animal. With this defect, which is common in women, there is a small feeble pulse, a dull or half livid tint in the parts which in healthy people are ruddy, a weak digestion, constipated bowels, and scanty menstruation.

"The cure of the ulcers and prevention of their recurrence lie in the remedy of these defects. Many tonic medicines may be useful, but the most so is iron; with it purgatives are generally necessary, *e. g.*, small doses of mercury and aloes or of sulphate of magnesia. Full diet also is required, exercise in the fresh air, very warm clothing, especially of the lower half of the body, and warm bathing; dry applications, or lotions of sulphate of zinc or copper, are the best local means, and the part must be kept warm; healing is always tardy at a low temperature."

Allied to these cold ulcers are those that are formed on fingers or other parts which have been deprived of their nerve supply from some injury.

In Sir J. Paget's able article in "Holmes's System," Mr. Busk, of the Seamen's Hospital at Greenwich, has also described the *scorbutic ulcer*. "Although scurvy in itself cannot be said to be attended with any peculiar form of ulceration, ulcers or sores of any kind already existing from other causes assume, in consequence of the scorbutic taint, a more or less peculiar character, and, when thus modified, have usually been termed 'scorbutic ulcers.'

"Scurvy essentially consists in an alteration in the constitution of the blood, which leads to the effusion into the various tissues of a *fibrinous exudation*, usually deeply colored, and which has on that account been commonly regarded as a simple coagulum. That this effusion, however, can scarcely be regarded in this light, is proved by several considerations, but more especially by the circumstance that it is from the first *solid and capable of becoming imperfectly organized*; that is to say, it is after a time permeated by newly formed vascular channels. It is the presence of this effusion which causes the spongy swelling of the gums, the tumefaction and induration of the intermuscular tissue, the so-termed *scorbutic nodes*, and which, when poured out on the surface or in the substance of the corium, constitutes the vibices and petechiæ so characteristic of the disease. It is the *effusion also of the same semiplastic material on the free surface of sores or ulcers which gives them the peculiar aspect termed scorbutic*.

"Ulcers of this kind are distinguished by their livid color and irregular tumid border, around which no trace of cicatrization is evident, whilst the surface of the sore is covered with a spongy, dark-colored, strongly adherent, fetid crust, whose removal is attended with free bleeding, and is followed by a rapid reproduction of the same material. This crust, in bad cases, as remarked by Lind, attains to a 'monstrous size,' and constitutes what has been appropriately termed by sailors 'bullock's liver.'"

The deep Cellular-membranous Syphilitic Sore has been already de-

scribed, but the superficial cutaneous rupial or syphilitic sore, deserves a notice, for it is common. It mostly succeeds an ecthyma or rupia, and is mixed with the eruption in some other stages; it is simply an ulceration of the base of a syphilitic eruption, and this ulceration goes on increasing irregularly, the sore in one part healing, in another spreading, in a ser-piginous form; it involves only the skin. The edges of the sore or sores—for they are often multiple—are usually well defined, and often irregular; the surface is generally of a deep color, the sore, when healing, may either scab or granulate up, as any other sore. These sores are met with at any period after the first constitutional symptoms of syphilis have passed away, and occasionally at a remote one; they are always found in a cachectic or enfeebled subject; indeed, it appears as if the want of power allowed the disease to crop up again, and manifest its former existence in the new form.

The cellular membranous sore appears at a still later date than the rupial, it being by no means uncommon to read in such a sore the specific character of a disease that had been contracted twenty or more years previously, and had laid dormant for so long a time, after having manifested its presence by marked symptoms; indeed, it is in such sores that the surgeon asks the question, whether constitutional syphilis is really ever cured—that is, eradicated—and whether a man once syphilized, like once vaccinated, is not so permanently altered as to show, under certain conditions, with comparative certainty, that he is still under the influence of the poison, and that other diseases forever after must be modified by its existence.

The treatment of these sores, when once recognized, is not usually difficult. Tonics, with the iodide of potassium in from three to ten grain doses, usually effect a cure, at least for a time; the liquor cinchonæ and compound spirit of ammonia in half drachm doses are good vehicles. In other cases quinine or iron is indicated. Mercurial remedies are sometimes called for, although rarely; the perchloride of mercury, in doses of $\frac{1}{16}$ th of a grain in bark, or the green iodide in one-grain doses in a pill, or the mercurial suppository, being the best forms.

Locally the sores may be dressed with any simple dressing, but when indolent a mercurial lotion, as the black wash, is the best.

Lupus must be classed amongst the ulcers; it has its origin in a skin tubercle, or skin tubercles, of a flat form, fleshy consistence, and pink, shining appearance. When the tubercles remain whole, and simply spread or repeat themselves, the disease is known as the "*lupus non exedens*;" but when they soften down and ulcerate, as "*lupus exedens*" (*vide* Fig. 31, page 125). This lupus ulceration, when once originated, progresses steadily, and destroys every tissue with which it comes in contact, in this one point simulating cancer, and when on the nose—its very favorite seat—the whole organ. The surface of the sore is sometimes free from all signs of granulations, but often very irregular; it is not painful; its edges are ragged, raised, and often everted; they feel spongy, not so hard as cancer, and not so well defined.

These lupus ulcers are more common on the face than anywhere else, and probably next in frequency on the female genitals; they are most destructive when left alone, but are often very amenable to treatment. They are more common in young adult life than in the old. They are closely allied to tuberculosis.

TREATMENT.—Although the disease has probably a constitutional origin, and requires tonic treatment, both by medicine and regimen, there is no disease that derives more benefit from local treatment; and of all modes, the free destruction of the whole growth is the best. Since I have em-

ployed the galvanic cautery as a local caustic, I have burnt down many of these lupus ulcers, and even tubercles, and have been surprised to find how rapidly a healthy cicatrix forms; as a caustic this form of cautery has no equal. When it cannot be obtained, the gas or actual cautery may be used, the patient under both circumstances being under the influence of chloroform.

When this treatment is inapplicable, the destruction of the surface by some escharotic should be undertaken, the chloride of zinc paste being probably the best. But whether the galvanic or actual cautery be used, or escharotics, it is essential that the whole tissue be destroyed down to healthy structures. In some cases I have, as it were, scraped or broken down the growth with the handle of a knife, or even cut off the margins, and then applied the cautery to the base of the sore, and the same practice may be followed when caustics are applied. In some cases excision is a good practice, the sore being left to heal.

Rodent Ulcers are closely allied to the cancers, and are more like the epithelial ulcer than the true carcinomatous form; they are local cancerous affections, and expend their force in destroying every tissue they attack, but they do not spread by means of the lymphatics or by secondary growths. They usually begin as a dry wart on some part of the face, head, or other locality, and after this wart has shed many skins it begins to ulcerate. The ulcer spreads slowly and irregularly; it has a border of new tissue, raised as a wall, to separate it from the healthy parts; outside the border the parts are soft and natural, inside they are generally smooth, as an indolent sore, devoid of granulations, and glazed. There is little discharge from these sores when superficial, but when they are extensive, and have dipped down deeply into other tissues, this is not the case; when they inflame, also, they discharge a fetid ichorous pus. They seem to attack healthy as well as feeble subjects, and have little effect upon the general health until they touch vital parts. They appear after middle age. They are to be treated locally, by their destruction—cautery, escharotics, or scalpel being used, as seems most applicable. In local sores, when the knife can be used, it is probably the best instrument; in others the galvanic cautery is unrivalled. In lieu of this the actual cautery may be used, and next to this escharotics; “the caustic burns through the entire depth of the solid disease, and upon the casting of the subsequent slough, cicatrization is rapidly completed.”—*Moore*. The chloride of zinc, potassa fusa, Vienna paste, or acid nitrate of mercury, may be used. The zinc rubbed down in a warm mortar with equal parts of fresh plaster of Paris is probably the best; it destroys and dries the tissues.

Cancerous ulcers will be discussed with the tumors.

CHAPTER XLIII.

MORTIFICATION.—TRAUMATIC, ARTERIAL, VENOUS; HOSPITAL GANGRENE, ETC.

- THE mortification of any part of the body signifies its death; when a soft part is “dying,” it is said to be in a state of “gangrene;” when “dead,” in that of “sphacelus.” The dead portion is called a “slough,” and the process of separation the act of “sloughing.” When a bone is dead, the term

"necrosis" is employed; the dead portion being called the "sequestrum," and the process of its separation "exfoliation."

The dead portion of any tissue is separated from the living by means of ulceration; and when the slough has been thrown off, the parts heal by granulation, as an ordinary wound. In the "sloughing phagedæna" the two processes of ulceration and sloughing are combined, the molecular death of a part, or ulceration, going on with the more general gangrene.

Direct violence, mechanical or chemical, may be the cause of mortification, either by destroying the vitality of a part at once, or by exciting inflammation in it that induces its death; such cases are called "traumatic." In this group a large proportion of the cases of gangrene are found.

In the second group are found those in which a part is starved for want of supply of arterial blood, the main artery of a limb being obstructed, either from operation, accident, or disease—"anæmic gangrene."

In the third group are classed all those cases in which the stagnation of blood is caused by the mechanical arrest of its venous circulation, with or without secondary inflammatory action—"static gangrene."

In all these groups inflammation plays, directly or indirectly, an important part.

Tissues suffering from defective nutrition, either the result of some want of nerve supply or energy, of extreme debility the consequence of severe illness, or other depressing influence, are more prone to mortify on slight causes than others.

When mortification takes place in tissues that are filled with blood, and more particularly with inflammatory fluids, "moist, hot, or humid gangrene" is produced; when in parts in which no such stasis exists, and where death of the tissues is the result of a want of arterial supply, "dry, cold, or chronic gangrene."

But these two forms are in a measure convertible, the rapidity of the process and the amount of inflammatory infiltration influencing the result.

Direct traumatic gangrene is well seen in the destruction of skin from the contact of some corrosive acid, such as sulphuric or nitric acid; the black or yellow slough that immediately follows the application of the caustic testifies to its action.

Indirect traumatic gangrene is well seen in the integument after the application of a blister to a child or feeble patient, the blister being followed by inflammation of the blistered part, and its subsequent death.

In bad compound fractures the indirect inflammatory gangrene is too often illustrated, the limb swelling rapidly, and the skin becoming of a mottled and livid hue; loose blisters or phlyctenæ of raised cuticle soon form on the surface, containing more or less blood-stained serum, and the tissues become sooner or later cold and insensible, the temperature of the part often falling rapidly. The fluids from the wound, when any are present, soon become offensive, blood-stained and mixed with gas, the tissues crepitating on pressure from its presence.

The gangrene may be local or it may spread upwards, but when the action has attained its limit the living tissues in contact with the dead become highly vascular, and a defined line at length appears, "the line of demarkation;" this vascular line goes on to ulceration, and, if left to take its course, to the separation of the whole slough from the living tissues; soft parts, and even bone, may be divided by it, the granulations on the new surface materially assisting the casting off of the slough. The deeper tissues of a limb thus affected rapidly decompose and give rise to a horrible fetor, the extent of decomposition depending much upon the fluids in the part. Should the limb be exposed, the integument will soon dry and be-

come black, gradually withering, the soft parts beneath undergoing the decomposition of dead tissues.

This process is rarely attended by hemorrhage, the blood in the vessels coagulating by the sloughing action and thus obstructing them. In exceptional cases, however, sloughing ensues, the more rapid the sloughing action the greater, apparently, being the liability to bleed.

Direct traumatic gangrene is also well illustrated in cases of extravasation of urine, or feces, and probably also by the action of some animal poisons.

The "*bed-sores*," met with in feeble subjects, are sometimes due directly to mechanical pressure on a part, but as often "indirectly" to the inflammatory action induced by the pressure, and the same may be said of the sores caused by the heel resting too long upon a splint. In paralytic subjects the slightest pressure will be followed by this result.

The best examples of gangrene, *caused by the cutting off of the arterial supply to a part*, are found after the application of a ligature to a large artery, such as the femoral, for aneurism or injury; the rupture of an artery, or its contusion—which often, either by lacerating its inner coats or by other means, is followed by its occlusion—the rare causes of embolic plugging of an artery, and the gradual closure of a vessel from local arteritis or degenerative disease, are also equally typical; and so is the abscess of the brain, or rather sloughing, that follows the application of a ligature to the carotid artery. In all these cases the part dies by starvation from want of blood, and the more sudden the act by which the supply is cut off, the greater are the probabilities of gangrene being the result. The sudden occlusion of a large artery, whether in the old or young, is liable to be followed by gangrene. Its gradual occlusion, except in the old, is more rarely followed by such a result, the collateral circulation supplying its place. In the form of gangrene called "*senile*," it is very probable that arterial obstruction, the result of atheromatous arterial disease, or of embolic plugging of the vessel from the breaking loose of some portion of the diseased arterial coats, is the immediate cause of the gangrene, but the feebleness of old age, the degeneration of the tissues that have been badly supplied with arterial blood, and often some slight local injury, are doubtless powerful agents in giving effect to the process. One or more of these agents may be the true cause of the gangrene, but they are probably combined in the majority of cases. When the gangrene is purely a dry, withering, or mummifying process, the cause is probably simply want of blood supply; when inflammation coexists, the gangrene will be moist, the feebly nourished tissues, either from injury or otherwise, becoming inflamed from some accidental cause, and dying.

In the gangrene met with in the young or middle-aged, from arteritis or embolism, the dry form is the usual one, the parts becoming cold, bloodless, waxy, and rapidly withering, turning black and mummifying. When caused by embolism, the onset of the gangrene, or rather the early indication of the plugging of the vessel, is marked by a sudden shooting or crampy pain down the extremity, this symptom being speedily followed by those of "*arterial gangrene*."

When caused by the gradual occlusion of the vessel this symptom is not present, and the symptoms of gangrene are more chronic.

The gangrene from "*cold*" may be the direct result of want of blood supply, or indirectly caused by the excessive inflammatory reaction that follows, "*or secondary mortification*." The gangrene following the "*ergot of rye*" is dry, but the mode of action of the poison is unknown; it follows precisely the course of gangrene from arterial obstruction.

The best illustrations of gangrene *from obstruction*—*static gangrene*, as it might be called—are seen in strangulated femoral hernia; after the use of splints too tightly applied; after the prolonged employment of the tourniquet to check hemorrhage; in a tight paraphimosis; in the sloughing of protruding piles; in the gangrene of a limb from the pressure of an aneurism or tumor upon the chief venous trunks; in the sloughing of the legs, groins, or other parts of patients suffering from some obstructive heart disease.

In all these cases the parts may die from blood stasis, but inflammation, more or less well marked, with its products, have generally an important influence in producing the result.

Mortification is thus a very compound process, and is brought about by mixed causes—direct injury, want of arterial supply, and blood stasis from mechanical obstruction to the return of the venous blood being the three main exciting causes of the affection. Inflammatory action in each of the three classes of causes thus grouped together has secondarily an important influence; feebleness of power, old age, want of nutrition or nerve supply in a part, renders a patient or tissue more prone to the action of these causes, and the process more active.

The constitutional symptoms associated with gangrene vary with its cause, but under all circumstances a depressed condition of the ordinary powers is to be recognized. In traumatic inflammation during the stage of excitement the pulse may be rapid and the beat strong, the fever high, and other symptoms present indicative of sthenic action, but when about to terminate in gangrene all these symptoms will be marked by a sudden fall, the temperature of the body suddenly dropping four or five degrees, from 104° or 105° to 99° F. This sudden fall precedes the gangrenous action, and no better symptom exists to indicate the sudden collapse of the powers of the patient. Some interesting observations on this point by Mr. Pick may be found in "St. George's Hospital Reports" for 1868.

When the mischief is extensive, and the gangrene spreads, what are known as typhoid symptoms may set in. In the more acute cases death takes places very rapidly, but in the chronic the constitutional symptoms are negative.

TREATMENT.—The most important point the surgeon has to bear in mind in the treatment of every form of mortification is that the condition indicates a depressed state of the system, and that as a consequence the general treatment should consist in harboring the patient's strength, and cautiously building up the feeble powers by means of nutritious food, stimulants, and tonics; at the same time allaying pain by local and general soothing remedies, such as opium, morphia, or chloral, for nothing depresses more than pain.

The cause of the gangrene is next to be considered, for its influence on practice is most important. To treat a case of gangrene the result of a local injury as one due to obstruction of an artery would be clearly wrong, and to deal with an example of this latter form in the same manner as with another due to blood stasis the result of mechanical obstruction to the return of the venous blood of a part would be unscientific. I shall consequently consider this question of treatment as applied to the three groups of cases already formed.

Traumatic Gangrene, when of a *limited* nature, need cause but little anxiety; it should be treated on ordinary principles of local cleanliness, by poultices, water-dressings, or the irrigation of warm water, with some antiseptic lotion, such as Condy's fluid, carbolic acid, chloride of zinc, or chlor-

alum. When the slough has come away the surface is to be treated as an ordinary sore.

When more extensive, *but yet defined*, and involving a portion of a limb, whether caused *directly* by the injury or *indirectly* by the inflammation that followed, the expediency of removing the dead part by amputation is not to be disputed. No more of the limb should be sacrificed than is absolutely necessary, and to insure this object the flaps to cover the end of the stumps may be cut of any shape. Thus, in gangrene of the leg it is better to amputate below the knee with any form of flap that can be made of sufficient size than at the joint, and it is far better to amputate at the joint than above it.

In "spreading gangrene" of a limb following an injury, however, the difficulties are great. To remove it at once, as soon as the action had declared itself, would be to take away what often might be saved, or to do that which will not arrest the disease; to wait too long, too often diminishes the prospects of recovery, and from the extension of the mischief renders the amputation a more formidable one or precludes the possibility of its performance. To amputate, however, while the mortification is spreading is clearly an unsatisfactory practice.

And yet, in cases of local injury such as follow compound fracture, in which the surgeon might be tempted to try to save the limb, the first onset of an inflammatory action that assumes a gangrenous form should be met by amputation; otherwise the secondary local action will seal the fate of a limb that under the most favorable circumstances alone might have recovered.

Where an injured limb has a good prospect of being made a useful one, an attack of inflammatory gangrene need not necessarily lead to its loss. Where the action is due to the injury, the sloughing will probably be local, and may so terminate that a good limb may subsequently be secured. Where the action is due to *general* and not local causes, the amputation of the limb will not arrest it; the same action will in all probability attack the stump, and continue till it finds a limit, or destroys life. When amputation is not performed the same limit will be found, or the same end; but with a line of demarkation indicated amputation may be carried out with a better prospect of success, and if the patient dies, the surgeon will not have helped him to his end. A gangrene from a local traumatic cause may be treated successfully by amputation, but a spreading gangrene, the result of a general or constitutional cause, cannot be thus dealt with, and when amputation is called for, it had better be postponed till the gangrene has ceased to spread, and some line of demarkation has formed to indicate the extent of the mischief.

In making this recommendation, it is quite true that it is against what is called authority. Erichsen says, "In traumatic gangrene amputation should be performed as soon as the gangrene has manifested itself, without waiting for the line of demarkation."

Spence writes, "In spreading gangrene, amputate without waiting for a line of demarkation." Pirrie says, "As the only chance of life, however slender, lies in immediate amputation, it ought to be performed at once, and high above the part affected." Brodie and Guthrie might be quoted for the same purpose, and H. Coote, in "Holmes's Surgery," 2d ed., says, that "the indications for immediate amputation are so clear and generally acknowledged, that he who shrinks from the responsibility of the operation stands exposed to just reproof."

But these authors do not seem sufficiently to recognize a difference between the gangrene due directly to the injury and involving the injured

part, and the rapidly spreading gangrene that begins at the seat of injury and travels upwards, the former being due to the accident and generally confined to its seat, nature being incompetent to repair it; the latter to some inherent weakness in the general power, which the local injury renders manifest.

When the gangrene originates from a local cause, amputation may be the best practice; when it originates from a constitutional one, it had better not be entertained till the action has ceased and a limit to the disease has formed.

Fergusson is clearly led to this opinion on account of the want of success he has met with in adopting the more usual practice, that of amputation; for when he writes, "I might, however, possibly in future resort to a similar practice, but should feel greatly inclined to wait for a line of demarkation," his opinion must be accepted as being against amputation in spreading gangrene.

In "spreading gangrene," therefore, it is wise to wait for some natural indications of its termination before amputation is thought of.

In civil practice, this rule is, to my mind, a wise one; in military practice there may be many reasons why it cannot be observed, for all conservative surgery, or treatment based on expectancy, has to be sacrificed to the exigencies of the moment.

How is spreading gangrene, then, to be treated? By general tonic treatment and local treatment based on general principles; by maintaining the part as free as possible from all fetid discharges; by local cleanliness and the use of antiseptic applications; by using all means at our disposal to give free vent to fetid discharges and relieve tension, and, when necessary, these ends are to be secured by means of incisions.

Under this practice, when nature is strong enough to check the progress of the disease, a limit to its extent will be formed, and the local affection become amenable to treatment; when no limit takes place, death will ensue, but no amputation would have arrested it.

When amputation is called for, on the arrest of the action, the limb should be removed as close above the diseased part as possible. There is no necessity to sacrifice any tissue, and much less a joint to make the amputation a neat one. The only point for consideration is, that the diseased tissues should be avoided, but beyond these no healthy tissues should be sacrificed.

In the treatment of *gangrene due to arterial obstruction* the objects of the surgeon are to prevent its extension, and to assist the separation of the parts when called upon.

To carry out the first object, the mortified parts may be wrapped in some lint dipped in oil, with or without carbolic acid, as indicated by fœtor; and the whole extremity should be raised to encourage the venous circulation, and surrounded with cotton-wool to maintain its warmth.

Abundance of bland nutritious food should be given, and stimulants with tonics to assist its digestion, and keep up the circulation. But anything like over-stimulating is to be condemned. Opium may be given freely to allay pain, the patient being kept gently under its influence. Where small parts are alone implicated, their separation may be left to nature; but where hands or feet are involved in the gangrene, the surgeon should assist nature's processes by amputation above the line of demarkation, or about it, as soon as it is indicated.

In the "senile gangrene," the surgeon's interference should be of the mildest kind, but when a limb dies from embolic plugging or occlusion of an artery, or from ergot of rye, amputation may be performed as soon as

the line of demarkation has been indicated, that is, assuming the general condition of the patient is such as does not forbid it.

Where "sphacelus" takes place after the application of a ligature to a large artery, early amputation is called for, it being wise to remove the limb about the line of ligature, rather than wait for nature to indicate the points; the adoption of this practice saves much constitutional disturbance and economizing power.

In the treatment of the *third group of cases, those of "static gangrene,"* caused by the mechanical obstruction to the return of blood from a part, the first thing the surgeon has to do is to remove the cause. In hernia he does it by dividing the stricture, in paraphimosis by freeing the prepuce; when it is the result of the application of a tourniquet or splints, by their removal, and so on; and if the parts involved are not irreparably lost, a recovery may take place by natural processes, their venous circulation being aided by position and other means.

When gangrene has taken place in a limb from this cause, its early amputation is called for, it being wiser to remove the dead part at once before secondary inflammation, that may spread and cause more loss of tissue, sets in; the seat of the mechanical force fairly indicates the extent of mischief.

In gangrene of a limb from a ruptured artery or aneurism the same practice should be followed for like reasons; delay, under all these circumstances, being as unnecessary as it is injurious.

Hospital Gangrene, or sloughing phagedæna, is an affection that attacks wounded or injured parts, and mostly in hospitals that are overcrowded, badly ventilated, and ill drained. At times it would appear as if generated in a ward too closely filled with patients who have suppurating wounds, at others as if conveyed into a ward by the introduction of a sloughing or fetid sore. Want of cleanliness and close attention to suppurating wounds, and want of attention to sanitary laws, have undoubtedly much to do with its propagation, for the disease seems to be contagious through its discharges, and infectious. Its contagious character is admitted by all, but some dispute its infectiousness. Guthrie, however, relates in his "Commentaries," the following striking fact bearing upon the point: "Burgmans says, that hospital gangrene prevailed in one of the low wards at Leyden, in 1798, whilst the ward above it was free. The surgeon made an opening in the ceiling between the two, in order to ventilate the lower or affected ward, and, in thirty hours, three patients, who lay next the opening, were attacked by the disease, which soon spread through the whole ward."

Two forms of the disease seem to exist. In one the ulcerative action is the more violent, wounds attacked with it rapidly spread, skin, subcutaneous and connective tissues all disappear under its action, and small sloughs take place at the same time. Blackadder relates how a vesicle forms and ulcerates, the ulceration rapidly spreading, leaving a sharp, well-defined edge to the ulcer. This form of the affection Delpech designated "ulcerous" and Boggie, "phagedæna gangrenosa."

In the second form the tissues die in masses, forming pale ash-colored, pultaceous, horribly offensive sloughs; these sloughs gave the old term, "putrid degeneration" to the disease. In one epidemic the ulcerative form will predominate, in another the sloughing, and at times it appears as if one form of the disease will give place to the other.

An open wound, as a rule, seems a requisite for the affection to fix upon, but not always, for, in 1849, when the wards of Guy's Hospital were filled with such cases, a contused part often took on the action, the affection commencing as a vesicle, its base turning at once into a grayish slough, which

rapidly extended. When the affection attacked a wound, its edges or surface would cease to secrete; then turn of a gray color, as a slough; and this slough would spread, small wounds becoming large ones even in twenty-four hours. When the slough had ceased to spread, ulceration would begin to throw it off; and the fetor of the slough, and the débris of the ulcerating tissues, formed a mass of decomposing material unequalled in any other affection. Skin readily died under the influence of the process on the connective tissue; but muscles became likewise involved; tendons and vessels gave way only in prolonged cases, hemorrhage being rare; the parts around the wound showed small signs of change till the sloughing had ceased and ulceration had commenced, when the line of separation would be indicated by a red zone.

The constitutional symptoms of the epidemic I witnessed were negative; there were certainly none to indicate the approach of the action; no fever, no disturbance indicative of overaction; and when the local symptoms had manifested themselves, great depression was very general. But it was always to be remarked that the constitutional symptoms were never in proportion to the extent of the local affection. When strong subjects were attacked the local mischief told but little upon their powers; with feeble subjects the effects were more marked.

Military surgeons have, however, related how the constitutional symptoms often preceded the local. Hennen states this very clearly; and Thomson, of America, found the same; but Blackadder, Delpech, Guthrie, and Macleod found the local affection took precedence in point of time.

It would rather appear, from the descriptions given of the different epidemics at various times, that the ulcerative form is more commonly preceded by constitutional symptoms than the sloughing; the sloughing being, apparently, a local affection at the first.

During the late German campaign Professor Billroth has met with a wound disease which he had not seen before, and which he terms "diphtheritic phlegmon," or "diphtheritic infiltration." He relates three cases in which the diphtheritic appearance occurred soon after operations, and was speedily followed by fatal collapse. The entire muscular structure of the part becomes hard and stiff, from an indurated infiltration, the surface of the wound being of a pale gray. The affection is especially distinguished from gangrene by an absence of any rapid increase of the ulcerative process or of inflammatory redness in the vicinity, the surface of the wound exhibiting a lardaceous whiteness, and not the greasy pulpousness of hospital gangrene. The broad, hard infiltration so soon following the operation, might seem to be due to contagion, by means of the dressings employed, but this is hardly probable. In its sporadic form it seems especially to affect the subjects of septic or pyæmic disease, and perhaps the existence of a certain condition of the secretions inclined to coagulation may favor its production.

TREATMENT.—Before all things *abundance of fresh air* is most essential, even to an air bath, as maintained by a constant current allowed to pass through the ward or room. The separation of the affected from the healthy, the free use of such antiseptics as may be fancied, and close attention to all sanitary measures should be scrupulously observed. During the early stages of the disease irrigation seems to be the best local treatment. *No sponges should ever be employed.* The next object is *to take away all sloughs and putrescent material*, and this must be done by carefully cutting away the existing slough with scissors or scalpel aided by the dressing forceps, and the mopping of the surface of the wound with cotton-wool or tow; *but the whole surface of the wound must be thoroughly cleansed.* The third

aim is to prevent the extension or return of the sloughing by local applications.

Of these applications nitric acid was formerly the chief one, the acid being freely applied all over the diseased parts, and carefully introduced into every hollow and excavation into which it could percolate.

To apply the acid, writes Welbank, "the sore must be thoroughly cleansed, and all its moisture be absorbed by lint or tow. The surrounding parts must next be defended with a thick layer of ointment; then a thick pledget of lint, which may be conveniently fastened to the end of a stick, is to be imbued with the acid, and to be pressed steadily on every part of the diseased surface till the latter is converted into a dry, firm, and insensible mass. The part may then be covered with simple dressings and cloths wet with cold water."

Dr. Goldsmith, of America, has spoken very highly of the value of bromine as an application, this drug arresting ulceration and turning sloughs into tough deodorized tissues, and he and others have brought forward sufficient evidence to prove its value; it should be applied as the nitric acid, freely to the whole surface, its application being repeated again and again when the sloughing or ulceration spreads. Iodine and the oil of turpentine have also their advocates, the latter, it is said, having the power to dissolve out the sloughs and change the action of the tissues. Delpech and other surgeons speak highly of the actual cautery, and when the galvanic cautery is to be had it should be used, the object of all these different plans of treatment being to excite a new action on the surface of the wound, and to destroy the sloughing tissues, which, doubtless, by mere contact have a power of keeping up or propagating the affection.

When the sore is extensive, chloroform should be administered during this local treatment. After the cauterization the surface of the sore may be dressed with the permanganate of potash, carbolic acid, or iodine lotion, opium being added to allay pain; bromine in solution, two drops to the ounce of water, is also good.

Dr. Packard, of Philadelphia, prefers the use of powdered sugar or thick syrup, sugar being a hydrate of carbon which does not give up its oxygen, and well known for its preservative powers in the case of meats. He dusts the parts with the sugar, and covers the whole with wet lint. When odor exists charcoal may be mixed with the sugar.

The CONSTITUTIONAL TREATMENT consists in abundance of light, nutritious food, milk being given as freely as it can be taken, with sufficient stimulants to maintain the circulatory system and assist digestion.

Tonics, such as quinine and iron, are often well borne in large doses, five grains of the former dissolved in half a drachm of the tincture of the perchloride of iron being a good recipe, or when quinine cannot be taken the tincture of *nux vomica* in ten-drop doses may be substituted.

Opium is an admirable drug when the ulcerative action is present, but in the sloughing stage it is not so well borne; to allay pain and give ease it may be given in any of its forms. Chloral is probably a good drug for the same purpose.

CHAPTER XLIV.

ERYSIPELAS AND ERYTHEMA.

ERYSIPELAS is a specific disease, due to the presence of some blood poison that has probably been introduced into the body from without; it is intimately allied with other blood poisons, such as are found in scarlet or puerperal fevers, or septicæmia in any of its forms (Chapter II); for these poisons seem to be convertible.

It manifests its presence in three ways: As a diffused cutaneous inflammation, "simple cutaneous erysipelas;" as a diffused inflammation of the cellular tissue, "diffused cellular inflammation;" and as a diffused inflammation of both skin and cellular tissue combined, "phlegmonous erysipelas;" the two latter forms together being included in the expression "cellulo-cutaneous." The state of the system, the temperament and habits of the individual, have much to do in determining the form of the affection; and whether the disease follows an injury, when it is called "traumatic," or occurs spontaneously, when it is styled "idiopathic."

The peculiarity of erysipelas lies in the diffused character of the inflammation, and in its atonic nature. It is both *infectious* and *contagious*.

The attack is at times preceded by some constitutional disturbance, but as often as not no such has been observed, the severity of the general symptoms in no way bearing any proportion to that of the local disease. Febrile symptoms, ushered in by chilliness and *rigor*, are the most usual, the tongue being probably a foul one, and the bowels constipated or relaxed. As the disease advances the fever may run high; delirium of different forms may appear, and the pulse be quickened, but if full it will always be compressible, and often irregular or intermittent; towards the close of the disease, particularly when terminating badly, the pulse will be small and weak.

Nunneley, H. Bird, and C. de Morgan assert that if the pulse rise in frequency after the sixth or seventh day it is a very bad sign. I cannot say I have observed this, although, as this is about the time that complications appear when they occur, it is possibly the case.

Frank has pointed out that when a patient has had febrile symptoms for some hours, attended with pain, tenderness and swelling of the lymphatic glands of the neck, he has no hesitation in determining that erysipelas is coming on. Chomel held the same view, and Campbell de Morgan relates "that Busk is so convinced of the invariable occurrence of affection of the glands before erysipelas appears, as to consider it a pathognomonic symptom, and he believes that, although the blood becomes affected, the actual primary seat of the local inflammation is in the absorbent system. Sometimes swelling and excessive tenderness of the glands precede by many hours the appearance of a blush on the skin." These views dovetail in well with those which Dr. Bastian brought before the Pathological Society in 1869, based on the post-mortem examination of a man who died from erysipelas in a state of delirium and stupor. In this case he found the small arteries and capillaries of the brain plugged with embolic masses of white blood-corpuscles, and suggested this condition as the cause of the delirium. He stated "that the blood change is a general one, and through every part of the body this blood is carried with its rebellious white corpuscles, so that we may expect that in all organs alike the same obliterations of small arteries and capillaries take place." Thus, when those of

the liver are involved jaundice may be produced, and when those of the kidney, albuminuria, these conditions being occasionally found in erysipelas.

If pathologically we accept Dr. Bastian's observations, and look to the conduct of the white blood-corpuscles for an explanation of many of the phenomena of erysipelas, we are fairly disposed to accept the clinical observations respecting the absorbent system to which Frank and Busk have called our attention, for the glands of this system and the white blood-corpuscles are generally recognized as having a close relationship. All these observations, however, require confirmation before they are accepted.

Local Symptoms.—In the *simple* form of cutaneous erysipelas mere excess of vascularity, as indicated by a vivid redness of the part affected, this redness rapidly spreading, is the one local symptom. A sensation of heat or tingling in the part may be present, and, in rare instances, small vesications. On pressure with the finger the redness will disappear, to return directly the pressure is removed, but there will be no pitting of the parts to indicate œdema. In a day or two these symptoms will subside or disappear, the cuticle desquamating.

In the *severer* form of cutaneous erysipelas the vascularity of the skin will be as intense as in the simple, but it may be more livid. It will be associated with some perceptible thickening of the parts, the inflamed tissues feeling raised on palpation. The inflammation will spread rapidly in one or other direction, sometimes occurring in patches, these patches joining. Where much cellular tissue exists œdema will rapidly show itself, as in the eyelids or scrotum. Small or large vesicles form on the surface, containing either a clear serum or a blood-stained or sero-purulent fluid, this latter form being indicative of great depression.

In the head or other parts, where the skin is tight, the feeling of tension is very great, and the surface looks shining, the features being altogether obliterated. There is rarely, however, much pain. The border of the inflammation is invariably well defined.

This disease runs its course in about ten days; for the first three or four it spreads, and, having reached its height, it declines, the redness and swelling gradually subsiding and the skin desquamating. In some cases a local suppuration takes place, and this is always to be suspected when any local retention remains after the subsidence of the inflammation. In the eyelids and other parts containing loose cellular tissue this result is common. In the cachectic subject the disease is always more œdematous than in the healthy. When this affection attacks a wound the general symptoms are the same, but the local ones are first arrest of secretion in the part and then ulceration; where union has existed, disunion appears, stumps and wounds sometimes reopening and discharging a thin ichorous fluid.

After the disease has subsided repair is usually slow, but, at times, it goes on healthily to a complete recovery.

Simple erysipelas, unless in the feeble or cachectic, is rarely a disease of much danger. When it attacks the scalp after head injuries it is exceptional to find it followed by bad consequences. In free-living subjects, and in others who have bad viscera, it is a dangerous affection, lighting up latent disease that often proves fatal.

Where the erysipelas attacks the mucous lining of the throat, fauces, or larynx, it may, from mechanical causes, threaten life.

In some cases the disease will affect different parts of the body consecutively, or leave one spot suddenly to attack another. Such cases usually indicate want of power, and are too often found in subjects who have some organic disease of the kidney or other excretory organ.

Diffuse Cellular Inflammation may clinically be looked upon as a form of erysipelas, the disease attacking primarily the cellular tissue instead of the skin. It is characterized by the same diffused form of inflammation and by the same atonic character. It is, however, more commonly the result of some local injury such as some punctured wound or dissection wound than is the simple form, but it is found in patients from whom no such history can be obtained. It is almost always associated with absorbent inflammation and glandular enlargement.

The disease appears as a diffused swelling and induration of the cellular tissue of the part affected, the tissues feeling infiltrated and brawny, and the skin being tense from overdistension. When suppuration or sloughing of the cellular tissue has taken place, fluctuation will be felt or crepitation, the parts often feeling boggy. The skin, if not previously inflamed, will now participate in the disease; it will inflame and ulcerate or slough, to allow of the escape of the pent-up pus or sloughing cellular tissue. When resolution takes place at an early period of this affection, the skin may escape uninjured, but this result is rare.

The constitutional symptoms attending these changes in the cellular tissue are always those of great depression. The febrile symptoms will be of the typhoid type, the pulse feeble from the first, although rapid, and the disposition to sink very marked. Profuse sweating is an early and a constant symptom. Delirium is often present, and visceral complications are, as a rule, the cause of death, the connection between this affection and septicæmia being very close.

Phlegmonous Erysipelas is a combination of the two former; it is far more serious than the simple, and as serious as the cellular inflammation. It is characterized by a diffused inflammation of the skin and cellular tissue together, the parts having a strong disposition to suppurate and slough. Resolution is almost an unknown termination of the disease, one case differing from another only in the extent of the destruction of tissue with which it is accompanied.

It is commonly the result of some punctured wound or injury involving the skin and cellular tissue beneath. It begins locally as a brawny infiltration of a part, the skin presenting the ordinary erysipelatous redness, but of a dusky hue; to the finger the parts will feel more solid, and will pit on pressure; the boundary between the inflamed and uninflamed skin will be less marked, and outside the limit of the redness the skin will feel firmer than natural, and the cellular tissue beneath as if infiltrated.

As the disease progresses, and the cellular tissue beneath the integument becomes infiltrated with inflammatory products, the skin will be made tight from tension, and will cease to pit on pressure; uniform hardness of the tissues will give place to a sense of fluctuation, as of fluid, or to a boggy, quaggy, crepitating feel of sloughing cellular tissue.

If the case be left to nature, the skin will thin and ulcerate in parts, or slough in masses, to give vent to the pent-up and sloughing tissues. Phlyctenæ appear over the dead portions of skin as in other forms of gangrene, while the pus and sloughs that escape are always fetid. In bad cases the whole cellular tissue of a limb may die in this way, with large portions of integument. Bands of skin, held down by fascia, are commonly left, which on recovery will become the centres of cutification.

In the ordinary run of cases this diffused infiltration of the cellular tissue is confined by the fascia to the subcutaneous tissue; but in some instances, when the cellular tissue that separates the muscles becomes involved, the case assumes a far more serious aspect, for the suppuration is then of a burrowing kind, the sloughing is far more extensive, and the

prospects of a recovery, with a useful muscle, becomes very slender; for muscles and tendons may not only slough wholly or in part, but on recovery taking place they become so closely bound together with all the other tissues as to be useless as moving organs. From this cause after phlegmonous inflammation of the hand and forearm, a stiff and immovable extremity is so often met with, the hand becoming a kind of fin.

The constitutional symptoms attending this phlegmonous erysipelas vary considerably, their severity depending much upon the rapidity with which the disease spreads. They are, however, in character the same as are found in the other forms of the affection, but probably more severe. The rigors are more marked, the fever is higher, and the pulse more rapid, the tendency to fall in power being always marked. Thus in the second stage of the disease—the suppurative or sloughing—the rigors frequently recur; cold sweats and fever intervene as in an ague, these attacks being indicative of suppuration. When the local affection is undergoing repair, or, at any rate, has ceased to spread, and these “false ague fits” persist, some internal or visceral complication may be looked for, the blood becoming poisoned as in septicæmia, often to the destruction of life.

Mr. Busk states that in every fatal case of this disease the post-mortem appearances of pyæmia are to be found.

TREATMENT.—The disease in all its forms being essentially an *atonic* one, nothing like “antiphlogistic” remedies are to be entertained, and the simpler forms having a tendency to run a definite course, the practitioner’s aim ought to be merely to guide his patient through the attack, and to ward off whatever might prove injurious. When the patient’s powers are good, and no indications of feebleness manifest themselves, a mild aperient or purge, to clear out the bowels, and bland nutritious food, such as milk and beef tea, are probably sufficient remedial means, the disease, on the third or fourth day, attaining its height, and then declining.

Should any feebleness or want of power appear at the beginning or during the course of the disease, tonics are indicated, and of all tonics iron seems to be the best. The tincture of the perchloride in half-drachm doses or more, frequently repeated to an adult, with or without quinine or strychnia, acting at times like a charm. The use of iron was introduced to British surgeons by Dr. H. Bell, of Edinburgh, in 1851, and stands unrivalled, although Velpeau, in 1841, had previously declared its value. It doubtless often cuts short the disease.

In the earliest stage of the affection, when the first patch of inflammation has appeared on the skin or around a wound, an emetic may at times cut short the attack.

When food cannot be taken, stimulants must be substituted, and it is often possible to introduce into them, and particularly into stout, some essence of meat. The form of stimulant must depend upon circumstances, but, as a rule, the one the patient has been in the habit of taking is the best. When brandy is given it should be mixed with milk, if possible, or eggs, it being always well not to give stimulants alone. The amount of stimulant must be regulated with care; over-excitation of the system is always bad.

Hypnotics or sedatives must be used with caution, for they are not usually well borne. Chloral, however, is the drug to use when any is called for, it being less liable to disagree than opium; camphor and henbane, in five-grain doses, are thought well of by some as a sedative, and ammonia is highly recommended by others.

In phlegmonous and cellular erysipelas the same principles of practice are applicable, and in the suppurative or sloughing stages the necessity of

giving abundance of good food of all kinds, and stimulants in proportion, is essential, strong animal broths and milk being the best forms.

LOCAL TREATMENT.—The inflamed parts should always be kept warm and raised; cold applications are injurious. It seems well also to keep the air from the surface; consequently, when the head and face are implicated with simple erysipelas, the old practice of flouring the parts is not a bad one; where warm fomentations can be applied they are the best, poppy, hop, or chamomile decoctions being used.

In the face and head, when the parts are very tense and painful, relief is readily given by following the practice of Sir R. Dobson, and puncturing the skin with a series of small punctures, oozing of blood or serum being encouraged by warm applications.

Mr. Luke used to think highly of the free use of collodion, applied over the part; Mr. Norris, of the compound tincture of iodine; Mr. Higginbottom, of a solution of nitrate of silver, twenty grains to the drachm of water; others, of the sulphate of iron a drachm to a pint.

The tincture of the perchloride of iron has been used for the same purpose. I have employed at times a mixture of iron and glycerin, but none of these applications have any certain power of arresting the progress of the disease; in some cases success seems to attend their use, but in others they appear useless. Some American surgeons, however, speak strongly in favor of the application of a solution of bromine on lint, with oil-silk over the whole. Mr. De Morgan thinks there are not many things more comfortable to the patient than a thick layer of cotton-wool placed over the part, to which powder or collodion has been applied. It is more soothing than fomentations.

The local treatment of the cellulo-cutaneous forms of the disease must be conducted on the same principles as the simple, but as soon as anything like tension of the integument appears, this tension being clearly caused by the presence of inflammatory exudation in the subcutaneous tissue, incisions should be made deep enough to allow of the escape of the effused serum from the cellular tissue beneath the skin, and long enough to relieve the tension of the whole. Some surgeons recommend the incision to be a free one, so as to extend the whole length of the affected part; the late Sir W. Lawrence advocated this. Others, amongst whom I must claim a place, prefer a greater number of limited incisions. The limited incisions answer the same purpose as the long, and are not attended with so copious a hemorrhage, or with so great a risk to life. Even after these the bleeding is at times profuse, but it may generally be readily arrested by elevating the limb and by temporary pressure.

When suppuration and sloughing exist the surgeon must let out all matter as soon as formed, for there is little doubt that the disease is kept up by its presence. The openings into these abscesses should be free, and their cavities kept clean by careful washing out at each dressing, a detail which adds materially to the comfort of the patient and the well-doing of the case. Condyl's fluid is as good a lotion to use as any other. De Morgan prefers a solution of chloride of zinc, fifteen grains to the ounce. Water-dressings should be applied to the parts, and frequently changed, a warm fomentation over the lint being often useful. Poultices are not so good, although at times patients say they derive the most comfort from them. During the period of repair the surgeon will often have to lay open sinuses. When the sloughing has been very severe amputation may be called for. It should always be borne in mind that erysipelas is a highly contagious and infectious disease. In hospital practice, consequently, every case, as it arises, should be separated from others in which wounds exist, and transferred to

a separate ward. All dressings and towels as they leave the ward or chamber should be burnt or disinfected; a sponge should never be used. Plenty of fresh air should be admitted to the room, but no draught; and disinfectants should be freely distributed about. No medical practitioner should go direct from a case of erysipelas to a midwifery case under any circumstances. Should circumstances oblige him to attend a labor when in attendance on such a case, he should allow as much time as he can to pass before he does so, and should attend then only after having changed his clothes and carefully disinfected his hands, for there is a direct connection between erysipelas and puerperal fever.

Erythema, in its clinical features, bears some resemblance to the simple cutaneous erysipelas, and has been mistaken for it. It appears as a rose or more vivid injection of the skin, of a local or general character, disappearing on pressure, and accompanied with some slight degree of œdematous swelling.

In its mere *transitory* form, when it appears as a cutaneous hyperæmia, it may be regarded as a symptom of some bowel or intestinal irritation, induced by irregularity in diet, or other cause; in so-called bilious subjects it is by no means uncommon, a local patch of redness on some part of the face, or other part of the body, often indicating the approach of a "bilious attack;" it is found, also, where organic disease of the intestines is present. In other cases it precedes an attack of small-pox, attends vaccinia, and is common in children.

Hebra gives the term *erythema fugax* to all these symptomatic forms of erythema.

Erythema, as a *disease*, more commonly attacks the extremities than the trunk, and the dorsal surfaces in preference to other parts. When the efflorescence appears in small patches of papules or tubercles upon the fingers or hands, the terms *E. papulatum* and *E. tuberculatum* are respectively given.

When these patches assume the form of a red ring, the term *E. annulare* is applied to it. When a second ring forms round the first, before it has passed away, or when it is represented by a small spot, the *E. iris* is formed; and where many such circles or half-circles appear together, and touch or coalesce and spread, the *E. circinatum* and *E. gyratum* are respectively present. Wilson mentions a case in which the *E. gyratum* covered the whole body; but all these different forms of erythema must be regarded as different stages of the same disease. Hebra says, "It will depend on the period at which the patient comes under medical observation whether the case shall be diagnosed as *E. papulatum* or *E. gyratum*." He gives one term to the whole, *E. multiforme*. As the disease subsides, a slight desquamation follows, and some small deposit of pigment.

All these forms run a definite course, and have a tendency to get well; they last from one week to three or four weeks. They require for treatment little else than attention to the diet and the bowels, correcting anything that appears wrong.

Erythema occurs at times during the secondary stage of cholera.

Erythema nodosum, however, is a more definite affection; it is found in both sexes, but in the female the more commonly; it is also usually seen upon the legs, but not rarely upon the arms and other parts of the body. It shows itself in raised and tender patches of very variable size, of a red color and oval form; some may be the size of a sixpence, others that of an orange; but when they run into one another, they still maintain their distinctness. At first they are of a bright red color, but as they die away they become of a livid hue, and appear very like a bruise, fading away

through a yellow stage. The cuticle always desquamates. When the disease is limited there may be no constitutional disturbance, but occasionally some febrile symptoms appear; there is usually some evidence of derangement of the digestive organs, such as a foul tongue. As often as not, however, the local disease is the first symptom that attracts attention. The eruption is often symmetrical. When it appears over the shin, and is very red and painful, it is not unusual to find it mistaken for some more serious affection, such as periostitis; but the absence of such constitutional disturbance as would be expected to attend such an affection ought to prevent any error.

The history of the case is enough to distinguish it from a bruise; and the different centres of redness or congestion, and the fading off into the other tissues of the infection, from erysipelas.

The treatment of this disease is simple. Saline purgatives, tonics, and a carefully-regulated diet being, as a rule, sufficient.

The application of a lead lotion to the inflamed part, and elevation of the limbs, are generally all the local treatment that is required; but in exceptional cases warm fomentations, with or without poppy decoction, give greater comfort.

The disease runs its course in two or three weeks.

Erythema nodosum is allied to the erysipelatous diseases, and is said by Hebra "to be essentially an inflammation of the lymphatic vessels. In fact, we see instances in which the tubercles are arranged longitudinally in the course of those vessels."

CHAPTER XLV.

DISEASES OF THE LYMPHATICS AND THEIR GLANDS.

THE absorbent glands, with their ducts, are liable to inflammation, "*adenitis*" or "*angioleucitis*," and this action is probably the result of the absorption of some septic material. It is almost always associated with a wound, punctured or open, inflamed, suppurating, healing, or scabbing; with some point of irritation or suppuration, even a papule or pustule; with some centre from which morbid elements may be taken up. In what is called a simple wound the inflammation of the absorbents may be acute, but in poisoned wounds it is violent and diffused. The inflammation always follows the course of the absorbents, leading from the centre of absorption towards the glands, that is, towards the body; it never spreads backwards. When it has reached the glands the diseased action ceases to spread; that is, it expends its force upon the group of glands in which the absorbents naturally end, and does not extend through another series of absorbents to a second group. The morbid material is arrested in the glands, at least such is the usual course of the affection. When pyæmia follows or complicates the case, it may be open to question whether the poisonous fluid circulating in the lymphatics has not been allowed to pass into the blood through its usual channels, that is, through the inflamed glands onwards; but it is at least as probable that the same septic material that poisoned the lymphatics, and set up inflammation in the tubes and glands, was taken directly into the blood through the venous channels, and thus gave rise to blood-poisoning.

Absorbent Inflammation usually manifests its presence in a definite way; pain in some of the glands and tenderness are generally early symptoms, and with these, or soon following, will be seen a band of redness, varying in diameter, leading from the wound or infecting centre towards the gland; this red line may be a continuous or an interrupted one; it may be a thin streak of redness or a broad stripe; and in some instances it so radiates into the surrounding tissues as to simulate erysipelas. The whole line of redness will be very painful, and with these local symptoms there will probably be some febrile disturbance, and probably the attack will have been ushered in with a rigor. It is to be noted that the red lines follow the course of the absorbents, and not of the veins.

Under favorable circumstances and treatment these symptoms may subside, and the red line, with the swelling of the glands and cellular tissue around the inflamed parts, and the constitutional symptoms, will then disappear.

In less favorable examples suppuration will take place; it may be as a local or diffused suppuration of the affected glands and surrounding cellular tissue; it may be as a local abscess in the course of the lymphatics; or as a series of local abscesses. In extreme cases the suppuration may partake more of a diffused character, such as that already described as taking place in phlegmonous erysipelas.

With these local changes the constitutional symptoms will assume different features; the febrile disturbance will probably be great, but it may be marked by depression; rigors may repeat themselves at regular intervals, these rigors generally indicating some suppurative process. When typhoid symptoms appear with rigors and sweating, the case has clearly become one of blood-poisoning or septicæmia.

There are thus three different classes of cases:

The simple, terminating in resolution; the more severe, ending in local glandular or lymphatic suppuration; and the complicated, marked by diffused inflammation and suppuration, with general blood-poisoning.

In the simple form the poisonous element is probably of a diluted or but slightly irritating nature; is generally some altered secretion of a simple wound, due to external irritation. In the more complicated or severe forms the poisonous element is of a more active kind, and has been either introduced from without, as by a distinct animal poison, dissection wound, bite of an animal; or generated from within, as seen in puerperal cases.

Inflammation of the absorbents, erysipelas, phlegmonous or otherwise, and septicæmia, are all closely connected.

The effects of inflammation of the absorbents are not, however, constant or alike in all cases. In some instances the glandular enlargement alone is to be recognized, with more or less extensive suppuration of the glands and their surrounding connective tissue, without any external evidence of inflammation of the lymphatics leading to the glands. In other cases the red line of inflamed absorbents will be very visible without glandular complication, or more than a slight induration of the gland.

At times there will be suppuration only along the track of the lymphatics, but none in the glands, this suppuration taking the form of local abscesses. I have seen in a case of absorbent inflammation of the forearm and arm four distinct abscesses in the line of inflammation, with only axillary glandular tenderness.

Occasionally the lymphatics appear as a hard cord beneath the skin. In a case I had under my care some years ago this cord remained hard, and contracted for many weeks after all signs of inflammatory action had ceased. It was in a gentleman who was in the habit at night of going

through some simple muscular exercises, and in doing this the cord in the arm on the inner side of the biceps snapped across. I saw him a few minutes after the accident, and felt the two ends of the cord; they were apart for about an inch. The next morning the thin skin covering the anterior surface of the forearm was elevated, loose, and baggy, from the effusion beneath it of fluid. There were no signs of inflammation or pain beyond local tenderness at the point of rupture of the lymphatic cord. In four or five days the fluid was reabsorbed, and convalescence was restored, the hard cord gradually disappearing, and all traces of its separation becoming lost. I looked upon the effused fluid as lymph that had been poured out by the divided tube, and had been taken up again. I have never seen a similar accident since.

This absorbent inflammation is most common in the extremities; it may, however, occur anywhere. There seems little room to doubt that a large number of the cases of glandular abscesses are of this nature; pelvic abscesses in women are known to be of this kind, for pus has been found in the absorbents of the part.

Glandular suppuration in the neck is, from its position, a dangerous affection,—the connective tissue of the parts being so loose, and the fascia covering them so firm, that burrowing suppuration often takes place. These deep-seated suppurations should be opened early, as soon as any local evidence of pus exists; the operation should be performed with a lancet through the fascia, and a director or forceps into the deep connective tissue. I lately opened an abscess at the base of the tongue in this way, from beneath the jaw, with an excellent result. The swelling affected deglutition and respiration, threatening life.

TREATMENT.—Whenever any indications of absorbent inflammation show themselves, the wound or sore should be well cleansed, the scab removed, and any collection of pus let out. The limb should be raised, the foot higher than the hip, the hand or elbow higher than the shoulder; and warm poppy fomentations applied along the whole course of the lymphatics up to the group of glands in which they terminate. A poultice may be applied to the wound. Some surgeons, particularly the French, advise that the inflamed line should be pencilled with caustic, and dry warmth applied, such as cotton-wool; but I prefer the practice I have indicated; it seems to give more comfort. Leeching is rarely, if ever, required.

As soon as suppuration appears the abscess must be opened, whether this follows directly upon the inflammation or subsequently; for, at times, suppuration is very insidious. At the very earliest period of the inflammation, when the tongue is foul, an emetic certainly seems to have some influence in checking its progress; it is a simple remedy, and a valuable one. A good saline purge is also of use.

Sedatives must be given to allay pain, such as small doses of morphia, three times a day, with a double dose at night, to give sleep; and tonics when suppuration has taken place, iron being the best.

In chronic cases, where induration in the track of the ducts remains, mercurial ointments and friction are sometimes of value.

Glands are very prone to inflame after fevers or the exanthemata, the cervical particularly so; and these affections often give rise to much local distress. In patients who are not extremely feeble these enlargements, as a rule, subside by themselves under careful management. In exceptional cases they suppurate.

Local warmth, applied by means of cotton-wool, tonics, and nutritious food, are the best means to use; but when suppuration threatens, warm fomentations are more grateful to the patient. Abscesses should be opened early.

Before opening the abscess, it is well to try what drawing off the pus by means of the "aspirator" may do, repeating the operation as the pus collects; in some instances a cure may be effected by these means, and thus the scar is prevented. Should it fail, an incision must be made.

The local application of iodine under these circumstances, although a common remedy, does not appear to be one of any value.

Chronic Glandular Enlargement is a very common affection; when found in the so-called strumous subject the disease is regarded as a strumous one of the glands, but it is very difficult to lay down any definite cause for its appearance. It is found, it is true, in the strumous and feeble child as a chronic and slightly painful enlargement of a gland or glands, more particularly those beneath the jaw and about the neck; it comes on sometimes after exposure to cold, some slight illness, local irritation, or without any definite cause, and often subsides spontaneously on the removal of the cause or the improvement of the general health. There exists, probably, always some local cause of irritation. At times, these glands suppurate and leave ugly sores, the cellular tissue around the gland becoming destroyed, and the skin consequently undermined. The pus from these glandular enlargements is, at times, ill formed and curdy; when it attends the breaking down of some old disease it may contain chalky deposit, this being some degenerated or dried-up tuberculous or other matter.

Hodgkin's Disease of the Glands.—There is, however, another chronic enlargement of the glands that appears to differ in all ways from the local enlargements to which attention has just been drawn. It was first described by Dr. Hodgkin in the "*Med.-Chir. Trans.*," vol. xvii, and may be called Hodgkin's disease of the glands, or glandular tumors, for the sake of distinction. He observed it first in the mesenteric glands, but any or all may be affected. In it the glands become very much enlarged, even to the size of an egg, and apparently more numerous; they present a smooth external appearance, and have a soft semi-fluctuating elastic feel. On section the surface of the gland presents a smooth, bloodless, semi-transparent, loose, succulent structure; microscopically it is made up of glandular tissue and abundance of fibro-nucleated tissue; it is of a tough leathery consistence, and exudes a clear serous fluid; the tumors are always free, each being separable from the others.

To the surgeon the disease, at times, appears as a local movable glandular tumor of a slow painless growth, which medicine has no power of influencing; it has the local clinical appearances of a benign fibro-cellular tumor, and has often been excised as such.

In other instances the tumors are multiple, three, four, or more existing in one locality, chiefly in the neck. In exceptional instances the tumors are more numerous. I have a case now under observation in which, on one side of the neck, the subcutaneous tissue seems filled with loose glandular tumors, readily movable one upon the other, as if simply confined by skin, in the same way as the adenoid tumors of the breast are occasionally met with. In still rarer examples the whole glandular system seems to be affected, every group of glands not only being apparently enlarged in size, but also increased in number.

This disease is often associated with an enlarged spleen, and appears pathologically to be allied to that blood disease now known as leucocythæmia, notwithstanding that in many case the white corpuscles are not in excess.

Not long ago I had an opportunity of watching the gradual development of this affection. The disease began in the cervical glands, and gradually

involved the whole glandular system, the boy, at the age of fifteen dying with an enormous spleen and glandular tumors in every region. His blood was made up almost entirely of white blood-corpuscles, and death took place from exhaustion.

TREATMENT.—For the ordinary or strumous enlargement of the glands in children there is no drug equal to cod-liver oil, the syrup of the phosphate or the iodide of iron or the tincture of quinine being capital additional remedies.

I have not much faith in the local application of iodine in the form of the tincture; after the second application the skin ceases to be an absorbing surface, and the iodine becomes, therefore, an irritant. For some years I have been accustomed to order the solid iodine to be put into a perforated box, and this to be placed upon a shelf in the sitting and bedrooms; the iodine in this way evaporates gradually and iodizes the air. In all glandular, as in thyroid enlargements, this mode of employing the drug seems to be of great value.

The iodide of ammonium as an ointment is a useful application when rubbed in, the iodide in this way becoming absorbed.

Good food and good air are also essential points in the treatment of these cases.

In Hodgkin's glandular tumors, iron, in full doses, and codliver oil, seem to be the best remedies; that is, patients who can take them appear to improve in their general health, and the disease does not progress so rapidly under their use as without; but, upon the ultimate issue, no remedy seems to have any decided influence, and it always ends fatally in two or three years. When isolated glandular tumors exist they may be dealt with as local tumors, and removed. This practice should, however, only be carried out when the tumor is in the way, and interferes with life's value or usefulness. Under other circumstances they had better be left alone.

In all glandular enlargements, however, with the exception of Hodgkin's disease, the local cause of irritation should be looked for, in order that it may be removed; for, practically, it is well to regard all glandular enlargements as due to a chronic source of irritation, in the same way as acute adenitis is known to be a result of inflammation of the lymphatics.

Lymphatics may be wounded by accident or design, and no bad result ensue. At times, however, a fistulous opening that discharges lymph may remain. The same consequence may be the result of disease. Dr. H. V. Carter, of Bombay, has recorded three such cases in the "*Med.-Chir. Trans.*," vol. xlv, and Dr. Day another case in the "*Clinical Soc. Trans.*," vol. ii. Through Dr. Day's kindness, I had an opportunity of seeing this case. It was reported on by a committee of this Society, and they confirmed the view taken of it. The case was one of hypertrophy of one lower extremity of a boy, with the occasional discharge of chyle from vesicles, which were formed on varicose lymphatics. The hypertrophy had clearly an intimate connection with the distended state of the lymphatics of the limb.

Disease of the glands, as connected with cancer and syphilis, are referred to in the chapters devoted to those subjects.

DISEASES OF THE URINARY ORGANS.

CHAPTER XLVI.

DISEASES OF THE KIDNEY.—STONE.—NEPHROTOMY.

Malformations of the Kidney have more scientific than surgical interest; yet they may have an important surgical bearing. For example, when the organ is single, and any accident happens to it from external violence or internal irritation, the life of the patient is more likely to be jeopardized than when it is double. In a case recorded in page 284 this fact was illustrated. When a single kidney exists, it is usually a large one; sometimes it takes on the form of a horseshoe, and assumes a central position, the convexity of the curve being downwards, when it may be regarded as a double organ, the vessels entering from above in their normal way.

A kidney may also hold a position nearer the pelvis, or even lie in the pelvis. When loosely connected, it may appear in the abdomen as a movable tumor. At times the kidney in the adult maintains the lobulated character it possessed in foetal life.

The diseases of the kidney are generally regarded as belonging to the physician; but I need hardly add that to the surgeon a thorough knowledge of renal pathology is as requisite as it is to the medical practitioner, for, without such a knowledge, he will be unable to recognize the different conditions of the urine with its deposits, and to appreciate their significance. He will also be unfit to decide upon the propriety of an operation of expediency, or to understand the risks of one of necessity; for the existence of kidney disease, as a rule, is enough to debar the surgeon from performing any operation other than that required to save life, and in such operations it renders the prognosis most unfavorable, since it is well known that the chief cause of death after operations is kidney disease, and the worst forms of the disease are undoubtedly directly due to calculous affections, to vesical and urethral mischief.

In all cases of operative surgery the condition of the kidney, as recognized by the urine, should be made out, and in disease of the urinary organs a most careful examination is equally required.

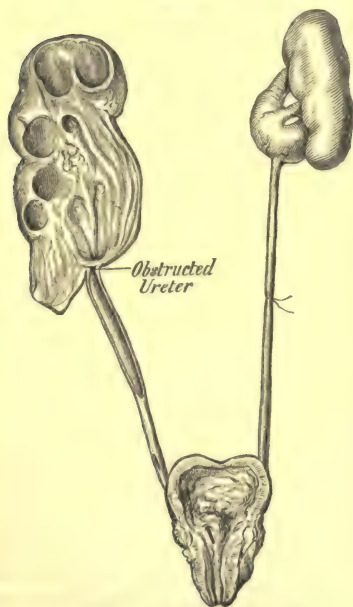
Nephritis, or inflammation of the kidney associated with suppuration of the organ, has long been recognized as a common consequence of obstructive disease of the urinary passages. But it may occur as a consequence of local injury, or as an acute attack upon a chronically diseased organ; as a consequence of pyæmia or other cause. It is also very common as a sequel to Bright's disease of the kidney—that is, to disease of the secreting glandular structure of the organ—in consequence of some local source of irritation in any part of the urinary passages. Bright's disease, by itself, is not a suppurative disease. Suppurative nephritis may occur as an *acute* affection, or as a *chronic* one, more frequently as an *acute upon a chronic*. After death, a “*surgical kidney*” may appear enlarged, with its substance more or less filled with suppurating cavities. When the inflammatory action is confined to the mucous lining of the pelvis of the organ, it is called “*pyelitis*.” At times the kidney is a mere cyst or shell containing pus and broken-down tissue, and, in extreme cases, the kidney and parts around form one large

suppurating cavity. This result is not rare as a consequence of the breaking up of tuberculous matter.

Symptoms and Diagnosis.—When after an injury in the loins, or in the course of some obstructive vesical or urethral disease, or calculous affection, a patient is seized with rigors, severe pain and tenderness in the lumbar region, febrile disturbance, nausea, vomiting, scanty, high-colored, and possibly bloody urine, and irritable bladder, *acute nephritis* may be suspected. When it is attended with rigors frequently repeated, suppression of urine, or the presence of renal casts or pus in the urine, suppuration of the organ is to be diagnosed; and when to these symptoms are added severe depression, anasæra, and brain symptoms passing on to coma, uræmic poisoning may safely be made out. The more free *blood-cells* there are in the urine the greater are the probabilities of renal hemorrhage; the more *pus*, of renal disease.

But **Chronic Nephritis** is a far more common affection than the acute; indeed, unless from accident, the acute is generally a sequel to the chronic.

FIG. 216.

Drawing 365⁶⁴, Guy's Hosp. Mus.

Kidney disease is a common consequence of long-standing or neglected bladder or urethral mischief. When a stone has existed for any period in the bladder, and has set up inflammation of that organ; when from prostatic disease the same result ensues, or from stricture the bladder, ureters, and kidneys have been subjected to the irritation and its consequences of distension from retained urine, the ureters become affected from the extension of mischief from the bladder, then the pelvis of the kidney, and subsequently the secreting structure of the kidneys themselves. Under these circumstances, every gradation of dilatation, inflammation, or suppuration of the whole urinary passages may be found. The bladder may be enormously thickened and inflamed, the ureters dilated, tortuous, thickened, and suppurating, the pelvis of the kidney expanded and filled with pus—“*pyelitis*”—and the kidney itself more or less undergoing disorganizing changes. (Fig. 216.)

The symptoms of changes such as these are not very definite. In all *long-standing* examples of obstructive urinary affections some such may be suspected, as well as in all cases of neglected stone, particularly when bladder symptoms are marked; when the urine is albuminous, pale-colored, and smoky, or tinged with blood; when it contains pus in suspension, varying in quantity at different times, or shreds of lymph; when a dull aching pain is present in the loins, shooting round the hips into the groin and down to the testicles, and when the digestive organs do their duty badly, and sleep is difficult to secure, or is superseded by a general drowsiness.

Under these circumstances, chronic kidney disease may fairly be diagnosed with or without suppuration in the organ, or around it.

When anasarca sets in, or brain symptoms from uræmic poisoning appear, the diagnosis is clear.

When rigors are frequent, even when not well marked; when lumbar pain is constant, and increased on pressure; when, on manipulation, evidence exists of some deepseated lumbar swelling, and fluctuation is distinctly or indistinctly visible, *abscess of the kidney* is fairly indicated. When with these symptoms a sudden discharge in the urine of large quantities of pus takes place, with relief to the local symptoms, it is probable that the abscess has discharged itself through the ureter; when the lumbar pain becomes more intense, the swelling more marked and prominent, and fluctuation more distinct, it is probable that the ureter has become obstructed, and the renal abscess is making its way through the loin externally; and cases are on record in which, after the discharge of the abscess by natural or surgical means, a recovery has ensued. Indeed, stones have been discharged from the kidney in this way with a good result.

Renal abscesses are, however, prone to make their way through the diaphragm into the lung or into the colon, rare cases being recorded where they burrowed downwards and appeared below Poupart's ligament, or in the pelvis. In these cases the symptoms simulate spinal disease, the thigh being flexed upon the pelvis; indeed, this symptom, attended with lumbar pain or tenderness, is a very constant one in nephritic abscess. Dr. Bowditch, of Boston, was the first to draw attention to this fact in 1869 and 1870.

TREATMENT.—When acute nephritis originates from a blow, or from the irritation of a renal calculus, complete rest in the horizontal posture in a warm bed is absolutely essential, with *milk diet* and the moderate use of simple diluents, as milk and water, or barley-water. Poppy fomentations to the loins always give comfort, and, when the pain is severe, leeching is beneficial; cupping has been recommended, and is practiced by some. The bowels should always be well cleared out by some simple medicine, such as castor-oil or an enema. All medicines that act upon the kidney, as salines or turpentine, all external applications, such as blisters, should be carefully avoided; for the same reason stimulants ought not to be given.

The action of the skin ought to be encouraged by outside warmth, and the hot-air bath, or steam bath, applied to the patient in bed, are valuable means to this end; a hot bath is a good substitute; calomel and antimony cannot be recommended.

When the case passes into the chronic stage, counter-irritation becomes of value, and as this cannot be obtained by means of blisters, cantharides acting powerfully on the kidneys, mustard may be employed, or a piece of lint saturated with a mixture of chloroform and alcohol applied to the loin, and covered with oil silk; dry cupping, also, is of great value.

When *acute nephritis* supervenes upon the chronic form, the result of long-standing disease of the urinary organs, or after operation, the whole principle of practice must be to soothe, to relieve pain, and keep life going. Nothing like mechanical interference with the urinary passages is to be thought of. Retention of urine should, of course, be relieved, but the utmost gentleness is to be employed in the manipulation. These cases are, however, as a rule, very hopeless.

In *chronic nephritis*, "surgical nephritis," the result of local disease, there can be little doubt that the best practice is the removal of the cause. When a stone in the bladder has set up the mischief it should be removed, and by the mode that induces the least local irritation. When a stricture of the urethra has been the cause it should be dilated, for as long as the local

cause of the disease exists no recovery can be looked for. When calculus in the kidney is the local irritant, the surgeon's aim must be to allay local irritation by keeping the patient quiet, and giving soothing remedies; the alkaline potash salts should be prescribed where the urine indicates uric acid calculus, and the mineral acids when the urine is phosphatic. The removal of the stone by operation may also be entertained.

When suppuration of the kidney takes place, with or without a calculus, and any external evidence of the abscess exists, an opening should be made; and it is a moot question with surgeons at the present day whether it is not better practice to anticipate this pointing by an early incision, but to this question I shall return.

When the urine is full of pus, the preparations of buchu are of undoubted value, and the mineral acids, or the preparations of iron, are often of use.

Attention to the skin, to maintain its action, and in this way relieve the kidney, to supply simple nutritious food, and stimulants only when absolutely required, make up the treatment.

Perinephritis is an affection that must be recognized, for, although it is found in connection with suppuration of the kidney, it is at times independent of it. It is indicated by a sudden pain in the loin, fever, and, subsequently, lumbar swelling, œdema of the integuments of the loin being a common symptom. At times the pain is constant and persistent, at others, it may appear and then disappear for an uncertain interval, to recur spontaneously in all its severity. The urine in an uncomplicated case is generally natural; if altered at all it may be scanty. When the case is left to nature to cure, the inflammation may attack the chest and induce a fatal pleurisy, or the abscess may burst into the bowel, or externally, and recovery ensue. The surgeon should not, however, leave these cases to nature, he should cut down upon the abscess or lumbar swelling, at the outer border of the quadratus lumborum muscle, as in colotomy, and let out the pus as soon as sufficient evidence exists of its presence; a good result under these circumstances may be looked for. (*Vide* paper by Dr. Bowditch, "Am. Med. Journ.," 1871.)

Hæmaturia, or bloody urine, is a symptom; the blood may be but little in quantity or profuse; it may come from the kidney or any part of the urinary passage; it may be due to some constitutional cause, such as the hemorrhagic diathesis; some morbid condition of the blood, as in purpura, scurvy, or fever; or to some injury or disease of the kidney, ureter, bladder, prostate, vas deferens, or urethra. In surgical practice the hemorrhage is probably due to some local cause, but the practitioner should always remember that it may originate from a constitutional or general one, or from the use of some drug. To find out the seat of the hemorrhage in any individual case, is always a point of great importance.

When the result of accident the diagnosis is not usually difficult. Thus, an injury to the loin, followed by the passage of blood mixed with the urine, generally means kidney mischief; an injury to the perinæum, or pelvis, a sudden muscular strain, followed by the flow of blood from the urethra, without urine, urethral mischief.

When urine, and blood in clots, pass together, the source of the bleeding is probably vesical or prostatic.

When blood comes from the kidney, as a result of disease, it will, as in cases of accident, be mixed with the urine; it may be very slight in quantity or very profuse, but the history of the case, the existence of lumbar pain or tenderness, and close examination of the urine, will probably point out the nature of the affection causing the flow, whether organic disease or

the presence of a calculus. Profuse hæmaturia takes place at times as an intermittent affection. The passage of a stone down the ureter will also be attended by hemorrhage. This is, however, rarely profuse; it is, moreover, generally accompanied with severe pain, of a colicky nature, shooting down the groin and scrotum of the affected side, with a retracted testicle.

Vesical or Prostatic Hemorrhage, whether from injury or disease, mostly shows itself as blood mixed with the urine in clots. The blood may fill the bladder, and for some days urine stained with blood will alone pass; but when the clot has broken up, irregular coagula, with fimbriated edges, more or less discolored, will pass with the urine, these coagula being very characteristic of bladder-clot. They will be passed, per urethram, as rolled-up masses, but when floated out in water will present their natural shape.

When the blood has been retained within the bladder for any time, the urine will assume a porter-like aspect.

When blood flows in small quantities at the end of micturition, squeezed out, as it were, by the bladder, a calculus may be suspected or prostatic disease. The same condition is also occasionally met with in the irritable bladder of gonorrhœa, or after the passage of "gravel."

When cancer of the bladder or prostate exists, pieces of broken-up tissue will probably be detected in the bloody urine by the microscope, and in villous growths the same condition may be found. In these cases, also, the hæmaturia will be intermittent.

Blood from the prostate often shows itself as urethral hemorrhage as well as vesical.

Urethral Hemorrhage, irrespective of injury, may come from a chancre, an acute gonorrhœa, or an impacted stone. It may be caused by straining in the retention due to stricture, in over-exertion, or sexual intercourse, in the forcible bending of an erect penis in a chordee, during some sudden muscular exertion from a rupture of the vas deferens, as pointed out by Hilton, and in rare cases without any known cause, the blood flowing from the penis unaccompanied by any symptom of disease. I have seen several such cases; and have recorded two such ("Clin. Surg.," Chapter 47).

As a result of catheterism urethral hemorrhage is too common; it may also be caused by the introduction of some foreign body into the urethra.

The surgeon must remember that the presence of blood may be simulated by bile, indigo, or other rare constituents of the urine. The black urine, resulting from the external or internal use of carbolic acid, is particularly to be remembered, as it indicates a poisonous effect of the drug. It soon disappears on the omission of the remedy. In a singular case that I had under care in 1871, that of a man who had a weak sore the size of a crown piece, which had been dressed with carbolic oil, one part of acid to forty of oil, the black urine appeared after the second dressing, with brain symptoms and collapse of the general powers, which I thought must prove fatal. They, however, speedily disappeared on its removal, and a recovery ensued.

TREATMENT.—The disease or condition that gives rise to this symptom requires treatment more than the symptom itself. Nevertheless, renal hemorrhage, when profuse, may be checked by gallic acid in full doses, gr. v to gr. x three times a day, or acetate of lead, or matico, opium being generally a valuable addition, and absolute rest in the horizontal position and simple cold milk diet being employed.

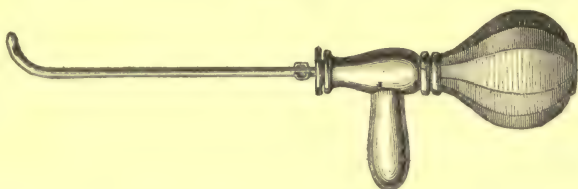
Hemorrhage into the bladder, when persistent, may be checked by the application of ice in a bag over the pubes, and to the perinæum; by cold or astringent injections into the rectum, with rest and opium. As long as the urine flows and retention does not occur, there is no necessity to pass a catheter or to interfere with the clot. The urine at the natural tempera-

ture of the body is a good blood solvent, and in the course of a few days will probably so cause disintegration of the blood as to allow of its being passed without help.

Any disturbance of the clot when first formed will probably rather tend to encourage bleeding than stop it. Consequently, no unnecessary catheterism should be employed.

When retention exists, and the symptoms are so urgent that opium, administered either by the mouth or rectum, the latter being the better mode, fails to give relief, some interference may be called for. This may be given by the passage of a large-sized catheter, and the use of such an exhausting syringe as Clover invented for lithotritry (Fig. 217), or the aspirator (Fig. 160); but in using these instruments great care is needed. They should only be employed when absolute necessity exists, and when opium in full doses fails to give relief.

FIG. 217.



Clover's syringe, as improved by Maunder.

Urethral hemorrhage rarely continues for any time, or requires for its treatment more than rest in the horizontal posture. The careful introduction of a catheter may be called for to draw off the urine, but the local cause of the bleeding is the one to treat.

Suppression of Urine is the result of renal disease, the kidneys ceasing to fulfil their functions; when persistent it is always fatal, the constituents of the urine being left in the blood, giving rise to coma, and possibly to convulsions and death. Uræmia or uræmic poisoning rapidly destroys life. It may occur in the course of kidney disease at any stage, and not uncommonly occurs after an operation performed on a patient with such an affection; it is a result to be taken into calculation before undertaking any operation where albuminous urine exists.

Suppression of urine, however, occurs in rare cases in patients in whom no such chronic mischief can be detected. It comes on suddenly without cause, and leaves suddenly without any reason. In such patients uræmia does not seem to be so common a result. I saw a musician once who secreted no urine for sixty hours, and then passed what seemed to be a natural secretion; his only other symptoms were those of slight feverishness and headache. In such cases the hot-air vapor, or warm bath, are the best remedies.

Stone in the Kidney is not an uncommon affection; it is generally a painful one, and is often fatal; but when the stone becomes impacted in the organ, and ceases to be movable, its presence does not appear to give rise to any marked symptoms, and, comparatively speaking, it ceases to interfere with life; it often, however, excites much local irritation, if not suppuration, and usually destroys life by destroying the kidney, which becomes a suppurating cyst. Small stones are constantly found in the kidney, and passed through the ureter into the bladder. Large ones may so increase as to form a cast of the pelvis of the kidney (Fig. 234).

The symptoms of stone in the kidney are lumbar pain, increased by riding

or any jolting of the body, the pain passing down the groin into the testicle of the affected side and causing its retraction, irritable bladder, and blood in the urine. When the stone gets into the ureter the inguinal and testicular pain becomes increased, and a colicky pain appears, attended often with sickness, and even collapse, the bladder becomes more irritable and the urine more bloody. When the stone passes, all these symptoms suddenly cease, bladder irritation probably alone remaining.

When the stone is found in the kidney the lumbar pain is the most common, shooting down the groin; and exercise, or any quick movement that may move the stone, excites bladder symptoms and hæmaturia. As time goes on, and the local irritation becomes worse, some suppuration in the kidney will occur. As long as the ureter remains open, and pus makes its escape into the bladder, the symptoms are not urgent; but should the ureter become closed by the stone, or by some inflammatory change, the pus collects, and gives rise to lumbar renal abscess. At times this lumbar swelling may be felt; indeed, in thin subjects a calculus may even be made out in the kidney by palpation, with one hand in the lumbar and the other in the hypochondriac region. This examination may be made with the patient under chloroform. The lumbar swelling may so increase as to form a large cystic abdominal tumor. When the ureter is obstructed this result will take place more rapidly than when it is open, for the pus accumulates; when the ureter is open it flows into the bladder, and passes with the urine as turbid urine. When allowed to settle in a porringer or glass its presence will be readily detected. Pus poured into the bladder from the kidney is mixed with but little mucus; pus formed in the bladder is mixed with much.

TREATMENT.—When a stone exists in the kidney the happiest result is its passage into the bladder, and this end is facilitated by the administration of diluents and alkaline preparations of potash, such as the citrate, tartrate, or bicarbonate. When much evidence exists of local irritation opium or henbane are valuable drugs, given either by the mouth or by the rectum; an injection of morphia under the skin over the affected kidney at times acts most beneficially. Fomentations about the loin and groin also give much relief, as does the warm bath.

When the stone is passing down the ureter the same practice is to be followed, a full dose of opium often relaxing the parts and favoring the passage of the stone. The administration of chloroform by inhalation, under these circumstances, may also be tried when the pain is severe. In one case I was called to see, where extreme agony existed, instantaneous and permanent relief followed the practice, the stone having passed during the period of its inhalation.

When the stone has become impacted in the kidney, and gives rise to periodical attacks of pain and constant uneasiness—each attack being worse than the last—an important question occurs to the surgeon. Is it to be allowed to remain, where it will, in all probability, set up irremediable disease if not destruction of the kidney? or is an attempt to be made to remove it by surgical operation?

Is a surgeon, in fact, justified in cutting down upon a suppurating kidney, whether resulting from a stone or any other cause, and giving free exit to the pus or removing the stone? Is nephrotomy an operation to be performed?

Nephrotomy.—It is impossible in this volume to enter into all the questions involved in the operation of nephrotomy, but, after full consideration of the subject, I have no hesitation in expressing my belief that, when a surgeon has made out with scientific certainty that a stone is impacted in

a kidney, and from the lapse of time it has been proved that the probabilities of its passage into the bladder are too feeble to rely upon; when, from repeated attacks of renal irritation, hæmaturia and the discharge of pus with the urine, it is clear that serious organic changes are going on in the kidney, that will lead to its destruction, and thus endanger life, an exploratory operation in the loin down to the affected organ is not only a justifiable, but a conservative and scientific operation.

When a large renal abscess exists it may be opened with facility. I have proved this in practice, having cut down upon a suppurating kidney in a man, and evacuated several ounces of pus with marked benefit, and had a stone been present, it could have been as readily removed.

The operation is not one of difficulty, nor is it one of danger; in both these points it is, probably, on a par with lumbar colotomy, and it is probable that in a few years it will be as recognized an operation.

The operation, in its several steps, should be the same as that described in page 367, for lumbar colotomy, the kidney being readily reached and dealt with through such an incision as was there indicated.

The operation is based on an imitation of natural processes, for stones have been discharged through openings in the loins.

Mr. Thomas Smith has written an interesting paper on this subject in the "Med.-Chir. Trans." for 1869.

CHAPTER XLVII.

DISEASES OF THE BLADDER.

ALMOST every disease of the urinary organs manifests its presence by some bladder symptom, and that symptom is usually what is called an *irritable bladder*, that is, the patient passes urine more frequently than natural, with or without pain.

Such a symptom may indicate simply some slight deviation from the healthy relations that normally ought to exist between the bladder and its contents; or it may be a symptom of severe, if not fatal, organic disease.

It may be a result of irritation of the glans penis from retained subpreputial secretion or from adhesion between the glans and prepuce; or it may be due to some serious cerebral or spinal affection. It may indicate kidney, bladder, prostatic, or urethral disease, and in many instances it is the one symptom that has induced the patient to seek advice. The "*irritable bladder*," although only a symptom, is, therefore, clinically an important one, and demands elucidation at the commencement of a chapter on bladder affections.

If the patient in which this irritability of bladder is well marked should be a child, the condition of the penis should first receive the attention of the surgeon; if the prepuce be very long, or adherent to the glans penis; if the secretion from Tyson's glands should have accumulated and have become indurated from want of cleanliness; there will be strong reason to believe that the irritability of bladder is the direct product of these apparently simple causes, and that on their removal the symptoms will disappear. To secure this end all retained secretion should be taken away; the adhesion between the glans penis and prepuce carefully separated; and, if the prepuce be long, circumcision should be performed. The practitioner should

bear in mind the fact that any of these simple conditions of the penis are sufficient to produce every degree of bladder irritation, and that a cure is only to be obtained by their removal.

If, however, no such conditions are to be observed on a careful examination, the surgeon's attention should be directed to the condition of the bladder.

It may be that on the passage of a sound, an instrument with a bulbous extremity being preferred (Fig. 240), a calculus will be detected; if so, the cause of the symptom will be clearly explained, and the practice to be followed equally laid down. It must be remarked, however, that if a calculus be the cause, a careful inquiry will detect the presence of other symptoms, such as hæmaturia, pain after micturition, and an occasional interruption to the flow of urine; all these symptoms may, however, be present in irritable bladder from an adherent prepuce, but the intermitting urinal flow is more characteristic of the presence of a stone. Should, however, a careful examination of the bladder fail to detect the presence of a calculus, it is not to be at once assumed that no such cause really exists; for, on a subsequent examination, the stone may be readily discovered; the calculus having at first been probably covered by one of the folds of mucous membrane of a partially contracted bladder. Should no stone be detected the condition of the bladder should receive attention; it may be that to the sound its mucous lining will feel rough, and the presence of the instrument will cause more or less pain and desire to micturate; under these circumstances the urine will be probably altered in character, and on its examination after standing, a cloudy deposit of mucus, if not of pus, will be detected. The latter deposit, however, is very rare in young subjects.

Under these circumstances the general health of the child will require attention; it may be that some slight aperient or alterative may be required, or perhaps a tonic; rest, as far as it is possible to be secured, should be enforced, and an alkaline mixture of potash given; the object being to make the urine as unirritating as possible, and thus allow the vesical mucous membrane to return to its normal condition.

The diet must be of the simplest nature, and meat is to be given in moderation, for in these cases it will be often found that the urine is unnaturally loaded with lithates, if not with lithic acid, and this tendency to the deposition of such ingredients would be increased by the free administration of animal food. Should, however, a case of irritable bladder in a child present itself to the notice of the surgeon, in which none of the conditions previously alluded to can be found to exist, and in which the penis, urethra, and bladder, appear perfectly natural, the state of the rectum should be inquired into; for the presence of worms, and more particularly of ascarides, is quite sufficient to produce an irritable condition of the urinary organs. These are readily removed by a jalap purge, or an enema of some bitter vegetable infusion, such as quassia; but the condition of the digestive apparatus will require attention, as it is upon it that the presence of worms essentially depends.

Excluding the presence of a stone as a cause of irritable bladder in young children, it has been already shown to be an affection of comparatively small importance if its true cause be accurately recognized; for the conditions upon which the symptom depends are rarely remediable, and the irritability of bladder rapidly disappears on their removal. In adult life, however, this irritability of bladder cannot be regarded in such a favorable light; for it is too often a symptom of conditions which are by no means readily removed, and which are of a very serious nature.

A congenital or an acquired phimosis, with a contracted orifice, or with

adhesions between the prepuce and the glans penis, are conditions which are amply sufficient to produce this symptom in the adult, as well as in the child; although these causes are not so common at the later as they are at the earlier periods of life; nevertheless they are causes of the affection, and as such require notice.

As a symptom of stricture, the irritable bladder is by no means without its value; and as a rule it indicates considerable narrowing, and probably a contraction which has been so gradual in its progress as to escape notice until its irritability of bladder enforced more accurate observation, and induced the patient to seek advice. It must be regarded as a result, therefore, of a urethral stricture, and can only be relieved or removed by the cure of its cause. It is doubtless produced by some chronic inflammatory action of the vesical mucous membrane, and as such requires treatment: the dilatation of the stricture, absolute rest, and the administration of alteratives being probably the best.

As a symptom of enlarged prostate this irritability of bladder is a complication of serious import; and also in old people where atony of the bladder exists, in whom no such enlargement of the gland can be observed. In both classes of cases, however, it is the product of the same cause, the symptom being evidently the result of a want of power on the part of the bladder to empty its contents; in one case from a mechanical obstruction, in the other from a loss of power in the parts to contract perfectly. The residual urine subsequently partially decomposing and becoming ammoniacal, thus acts as an irritant to the mucous membrane of the bladder, and gives rise to the irritability.

The treatment of these cases is not, therefore, a task of difficulty; the removal of the urine, and the prevention of its subsequent retention by the cautious employment of a catheter, is most important; the frequent washing out of the bladder with warm water, or with water medicated by some solution of morphia, opium, or nitric acid, according to circumstances, is also a very valuable practice.

The recognition of the cause of the symptom, however, is the main point for the surgeon to bear in mind, the practice to be followed readily suggesting itself when the cause is understood. As a sign of gravel an irritable bladder is of importance, and a careful examination of the urine will alone determine its true meaning. As a symptom of calculus in the bladder it is constant and valuable, although in some cases of stone it is extraordinary how little irritation the presence of a calculus will produce. As a sign also of organic disease of the bladder, irritability must not be passed over; but the obscurity of this class of cases is very great, and the correctness of diagnosis must rest upon the combination of many symptoms, no one being of greater value than another. In women this symptom is a common accompaniment of uterine affections, and in both sexes it is often associated with rectal disease.

And lastly, this irritability may be the product of a renal affection, where the urethra and bladder are evidently perfectly sound. The absence of all symptoms of disease in these parts, aided by the presence of other renal symptoms, and by what is of great importance, the careful chemical and microscopical examination of the urine, is alone sufficient to enable the surgeon to arrive at something like a correct diagnosis. But the practical point for remembrance is the fact that renal disease may give rise to all the symptoms of a vesical affection; and that when these are present, and a careful examination fails to explain them by the presence of vesical disease, the probability that some renal affection is the cause may be fairly assumed.

Irritability of bladder may also be produced by some cerebral or spinal disease, but the fact can only be alluded to in these pages.

The passage of a large quantity of urine, as in diabetes, should not be mistaken for irritability of bladder.

Inflammation of the Bladder.—Cystitis is a common affection in connection with stone, prostatic disease, stricture, or gonorrhœa; it is usually *chronic* or *subacute*, the more acute symptoms mostly supervening upon the chronic. As an *acute* idiopathic disease it has been described by authors, but clinically such an affection is hardly a recognized one. I have never seen it; if it ever occurs it must be very rare. The most acute cases are those occurring in gouty subjects, as a catarrhal affection.

The *chronic* form is the direct consequence of local irritation produced by the presence of a tumor, stone, or other foreign body; it is found in all cases where the flow of urine is interfered with, whether from prostatic disease or urethral obstruction, the bladder being irritated by the retained and decomposed urine, and its own ineffectual attempts to evacuate its contents.

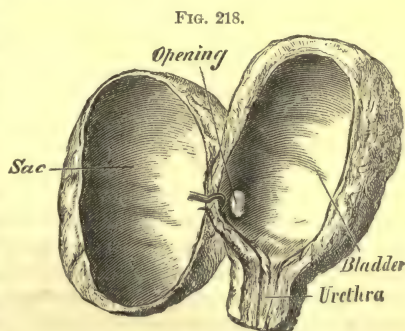
When the bladder is paralyzed from over-distension, spinal injury, or disease, and is unable to expel its contents, a similar result ensues, and it is under these circumstances that the more acute forms of the disease, and the worst pathological conditions, are found.

Subacute cystitis is commonly the result of gonorrhœa, the inflammation of the urethra spreading to the bladder.

The seat of the inflammation is the mucous membrane, which becomes thickened, rough, covered with flakes of adherent lymph and phosphatic secretion, at times ulcerated, and in the acute forms of the affection detached in fragments or as a whole, and thrown off as a slough. This latter condition is generally met with in the bladder of the paralytic, and is probably as much due to the deficiency of nerve supply as to the intensity of the inflammatory mischief, catheterism having often too much to do with it.

In chronic cases, the walls of the bladder become greatly hypertrophied from their own action, thick muscular bands being very visible, and where the obstruction to the exit of the urine has been of long standing, this thickening of the walls of the bladder is associated with its dilatation. Under these circumstances it is common to meet with saccular dilatations of the mucous membrane, the mucous lining of the bladder becoming pressed outwards as a hernia, between the bands of muscular tissue, forming the walls of the organ. These pouches are usually small, but in exceptional cases (as seen in Fig. 218) they may be double the size of the bladder itself. Into one of these pouches a stone may occasionally fall and rest, in this way becoming encysted. At times these sacculi are multiple.

Symptoms.—When the disease is subacute, the symptoms are irritability of bladder and inability to retain urine, the desire to pass water being often associated with its uncontrollable passage. The act of micturition is attended with pain, and followed by straining, blood being frequently squeezed out by the forcible contraction of the organ. Pain is mostly present above the pubes, in the perinæum and penis, often over the sacrum



Prep. 2087⁷⁵. Guy's Hosp. Mus.

and in the groin. With these local symptoms there may be those of febrile disturbance, more or less severe.

The urine will be found to vary in character according to the cause of the disease. When it has originated from the extension of a gonorrhœal inflammation of the urethra, it will be cloudy from the presence of mucus, or even pus, and at times stained with blood, this blood having been passed during the act of straining at the end of micturition.

In other cases of chronic disease (*catarrhal cystitis*), the urine will be mixed with grayish, viscid, ropy mucus, or muco-purulent fluid, which sticks to the bottom of the chamber vessel, and together, so that when turned out it falls as a glutinous mass. The urine will probably, in chronic cases, be alkaline or ammoniacal; in subacute, acid; in neglected cases, the discharge of mucus becomes enormous, and phosphate of lime often becomes mixed with the mucus and forms stone.

When ulceration of the bladder is present all the symptoms are aggravated, and the local pain is severe; bleeding is a common accompaniment, the blood being either mixed with the contents of the bladder and passed as dark-colored urine, or as clots of blood.

In the cystitis of gonorrhœa it is probable that the mucous membrane about the neck of the bladder is alone affected, in the more chronic cases of disease the whole surface and submucous tissue.

TREATMENT.—Whatever may be the local cause of the cystitis, the local symptoms require attention, although for a cure the removal of the cause is most essential.

Rest in the horizontal posture, hot fomentations, or the hot bath, simple diluents, such as barley-water, linseed tea, milk and water, with alkalies, as the citrate of potash in scruple doses, or the bicarbonate of potash in ten-grain doses, three times a day, and, above all, sedatives, are most essential. Of the sedatives, hyoscyamus is the best in half-drachm or drachm doses of the tincture every two or three hours, and where this is not enough, opium may be substituted. The morphia suppository is an excellent remedy, or an enema of starch with opium.

The bowels should be relieved by enemata in preference to purgatives, although, when severe constipation is present, a good mercurial purge is often of value; leeches to the perinæum are sometimes of use.

Where the kidneys are diseased, opium must be given with great caution.

When retention of urine complicates the case, catheterism is called for; an elastic catheter should be used, with the utmost gentleness.

In chronic cases the infusions of buchu, uva ursi, pareira, or senega, are excellent remedies, the tincture of cubebs or copaiba at times acting beneficially; the tritium repens, as introduced by Sir H. Thompson in the form of a decoction, two ounces to the pint, is also a valuable drug.

When gout is the assignable cause, colchicum sometimes acts as a charm, and in some cases of gonorrhœal cystitis the same good effect is often experienced. The best way is to give it with five-grain doses of the carbonate of lithia. When stone is the cause it should be removed; when stricture coexists it must be dilated; when enlarged prostate or atony of the bladder in the aged is the cause of the cystitis it is essential to keep the bladder empty, and prevent any residual urine remaining to decompose, and thus add to the irritation; for this purpose the catheter should be introduced daily, and in severe cases the bladder washed out, either by a stream of tepid water or medicated solution. Ten minims of diluted nitric acid to five ounces of water is the best form, or the same quantity of the tincture of iron. When the urine is fetid Condyl's fluid, or a few drops of carbolic acid, may be added to the water.

In doing this the greatest gentleness should be observed ; to force fluid into a bladder by a syringe is a dangerous practice, unless in skilled hands, and to introduce more than three or four ounces of fluid is unnecessary. The best method is by means of a piece of india-rubber tubing, two or three feet long, fitted to the top of the catheter after its introduction, and the gradual pouring of the water or solution, made warm, through a glass funnel fitted to the other end. The tubing can be raised to increase the pressure of the fluid, or depressed, according to the necessities of the case, the bladder resisting the slightest distension by its contraction, and the expulsion or elevation of the fluid into the funnel. By these means no harm can possibly accrue to an inflamed bladder. (Fig 219.)

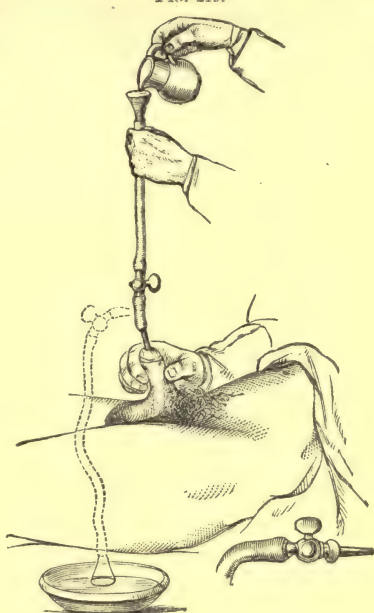
After the fluid has been introduced and left for two or three minutes it should be withdrawn, and fresh fluid poured in where necessary, the funnel being depressed below the level of the bed for emptying the bladder. Anodyne solutions are said not to be of much use in these cases, but I have been in the habit of introducing half a grain, more or less, of morphia, after the washing out of the bladder, with apparent advantage. When the washing out of the bladder increases the irritation it should be discontinued. At times a double catheter is of use, the injection flowing down one side, and the contents of the bladder out at the other.

In the inflamed bladder associated with atony, the tincture of the perchloride of iron is a valuable drug, or the dilute nitro-muriatic acid, given in twenty-minim or half-drachm doses three times a day ; but, in a general way, alkalies are called for, the urine naturally being secreted acid, and thus, as it is poured into the inflamed bladder, being an irritant. The diet, under all circumstances, should be nutritious, but unstimulating, alcohol being given carefully, according to the patient's powers. In all cases, however, of inflamed bladder, the surgeon must remember its cause ; it is generally due to some obstruction to the flow of urine, or local cause of irritation, and for a cure the removal of its cause is essential.

Ulceration of the Bladder is rarely the result of ordinary cystitis ; in the paralyzed organ, where catheterism has been frequently employed, it is met with after death, and in cases of stone. It is likewise found in tuberculous subjects, from the breaking down of tuberculous material, as well as in cancer. The disease is indicated by the same symptoms as exist in inflamed bladder, with more local distress, more blood in the urine, and greater pain after micturition. There is usually also much constitutional depression and want of power.

The indications for treatment are similar to those for cystitis, opium being freely used as a suppository or an enema ; all mechanical interference being avoided, unless absolutely called for, and then it should be of the gentlest

FIG. 219.



kind. It is a question, however, in the severer forms, whether an incision into the bladder, as for lithotomy, would not be a sound practice, the urine then flowing away as secreted, and a chance given to the bladder to recover itself; at any rate, the operation would give relief.

Vesico-Intestinal Fistula.—This is sometimes met with, and it seems probable, in the majority of cases, that the ulcerating process commences in the bowel, and involves the bladder in a secondary way. It usually first manifests its presence by the passage of wind with the water, some little irritability of bladder having previously existed; fæces—liquid or solid—soon follow, giving rise to fetid urine and severe bladder symptoms. The pain of foreign material in the bladder is very marked, at least when the large intestine or rectum is involved; for the liquid motion of the small intestine does not appear to give rise to the same local distress as the solid does.

There is no difficulty in recognizing this mixture of urine and intestinal contents. When flatus passes per urethram the condition may be suspected; when the urine has a fecal odor and color the suspicion becomes something more; and when solid fæces are visible the diagnosis is certain. In doubtful cases the microscopical examination of the sediment of the urine will readily reveal its nature. At times the fæces may obstruct the urethra, and cause retention.

In looking into the history of these cases there will usually be found some bowel symptoms—some diarrhœa or dysenteric affection—some symptoms of stricture or cancer of the bowel; and although this affection may be found associated with cancerous disease, it seems far more commonly to be the result of the simple perforating ulcer of the bowel.

TREATMENT.—When a fecal fistula has once formed between the bowel and bladder, the hopes of an unaided natural cure are very feeble, and when solid motions mix with the urine, but little can be done to palliate the suffering that is produced; for a time the bladder may be emptied of its contents, and, by being washed out, freed of its local irritant; but the truce will be but for a limited period, another action of the bowel being to a certainty followed by a fresh entry of feculent material into the bladder, with all its evil effects.

When liquid motions, or small intestine contents, communicate with the bladder the symptoms are not nearly so distressing, and the necessity for interference is much diminished.

The only means the surgeon has at his disposal, by which relief can be afforded, is colotomy; and when the rectum is the seat of the disease, whether cancerous or otherwise, lumbar colotomy ought to be performed. By it the fæces are diverted from their natural channel, and discharged through the loin, and all the miseries of the bladder complication are effectually relieved. When the ulceration is of a simple kind, there is some prospect of its closing; when of a cancerous nature, such a result cannot be looked for; but under both circumstances a large amount of relief is immediately afforded, and life prolonged.

I have had four cases of simple vesico-intestinal fistula, in which this operation—lumbar colotomy—has been performed with marked success; one died four months after the operation from kidney disease, and three are now alive, in comfort and in good health. In chapter xxxv this operation has been described. Mr. Holmes and Mr. Pennell, of Rio, have both had similar cases. For further information, *vide* Holmes's paper, "Med.-Chir. Trans.," 1866-7; and case, with remarks, by author, "Brit. and Foreign Quarterly," Jan., 1869; "Clin. Soc. Trans.," 1872.

Tumors of the Bladder.—These, as met with in practice, may be *warty*,

fibrous, villous, epithelial, or cancerous; the first three benign growths are usually more or less polypoid, and connected with the mucous or submucous tissue of the bladder; the epithelial and cancerous are more infiltrating.

The *warty* and *fibrous* are most commonly found in children, and give rise to symptoms similar to those of stone and urinary obstruction. They are rarely attended with hemorrhage, in this point differing widely from all other vesical growths. In the early stage they cause bladder irritation, and in the later, as they approach the urethra, difficult micturition or retention; at times in females the polypus may protrude through the orifice of the urethra. They cause death usually by obstructing the urinary outlet, and inducing organic disease in the bladder and kidneys, suppurative nephritis being a common cause of death. Pathologically they may appear as outgrowths from the mucous and submucous tissue, gradually becoming polypoid, the expulsive action of the bladder doubtless having considerable influence in encouraging this result. They are composed of fibro-cellular or fibrous tissue, not unlike the polypus of the nose; at times they assume more of a warty character. They are sometimes, although rarely, single, many pedunculated growths springing from a single base; occasionally they appear to cover a large surface of the bladder. In Fig. 220 (taken from a preparation 2104²⁸, "Guy's Museum"), this condition is well seen. It was described by Sir A. Cooper as "Tumor of the mucous membrane of the bladder everted. Polypoid excrescences producing symptoms of stone." Occasionally polypoid outgrowths spring from the prostate gland, and give rise to similar symptoms.

FIG. 220.



TREATMENT.—Little but palliative treatment has hitherto been employed in these cases; for the disease has been little understood and rarely treated. Warner, however, an old surgeon of Guy's, in 1747 incised the urethra of a woman, æt. 23, who was suffering from a polypus, and put a ligature round the peduncle of a growth the size of a turkey's egg with complete success; and Dessault, after removing a stone from a male, successfully twisted off a polypus that he found in the bladder. Mr. Birkett, in a striking example of the disease occurring in a child æt. 5, applied a ligature to the growth, but the patient died with suppurating kidney ("Med.-Chir. Trans.," 1858), the effects of the disease; and on reading the descriptions of other cases the practicability of successful operative interference does not appear hopeless. The case, when left to nature, can have but one ending. When the diagnosis can be made with tolerable correctness, even in the male an incision into the bladder, as in lithotomy, with the view of applying a ligature to the base of the growth, is not a dangerous operation, and may in pedunculated tumors prove successful, and when the growth cannot be removed the operation will doubtless be of value in giving a free opening for urine to escape and for the growth to expand, in this way relieving symptoms. In female subjects the prospects are even more favorable; should it be possible, when the bladder has been laid open, to remove the growth by torsion, ligature, or excision, a cure may ensue; should it prove impossible, relief will to a certainty be afforded to all the symptoms and life prolonged.

Villous or Vascular Growths—for these terms are synonymous—are

found in the bladder, as in any other part of the urinary passages; they grow from the mucous or submucous tissue, and appear as tufts of villous processes, like the villi of the chorion. They are usually small in size and at times are multiple, that is, two or three of these tufts are found in the same subject; occasionally, however, the interior of the bladder seems covered with these villous growths. In an example recently under my care

this was the case. They are essentially innocent in their nature, and have no relation to cancer, as formerly believed.

They possess, however, this peculiarity, that they bleed profusely, and even from a single tuft the size of a nut fatal hemorrhage may occur. In this point they differ widely from the polypoid tumors last considered, for in these hæmaturia is usually the first symptom that attracts notice, and the most persistent; indeed, it is often the only one. Should the growth in any way affect the orifice of the urethra, obstruction may exist, but not otherwise. For diagnostic purposes the urine should always be most carefully examined, as it is by no means uncommon for some of the villous tissue to be passed with the water, and under the microscope its true nature revealed. In a case I saw some time since, with Mr. Dukes of Canonbury, of a female child who had several attacks of hæmaturia,

I caught in the eye of my catheter, with

which I was examining the bladder, a small villous growth, and accidentally pulled it away. Microscopically its structure was characteristic, and the child had no return. Fig. 221, taken from a drawing, illustrates one of these growths. Each villus is composed of elongated nucleated cells and loops of bloodvessels, and is covered with columnar epithelium.

TREATMENT.—There is no cure for this affection, the surgeon can only relieve symptoms; pain and irritability of bladder by sedatives, retention by catheterism employed with extreme gentleness, and hemorrhage by astringents, as gallic acid and iron. Astringent injections have been recommended. The disease usually destroys life in about two years.

A patient of mine has, however, lately died, who had symptoms of it to a marked degree for eight years, with hæmaturia, at times profuse. The whole mucous surface of the bladder was covered with this villous growth, the bladder was hypertrophied, and the kidneys were diseased as in an ordinary obstructive affection.

Cancer of the Bladder is a disease of the old or middle-aged; it may occur as a primary disease of the organ, but more commonly from extension of disease from the rectum, uterus, or prostate; it may, therefore, assume the form of the hard, soft, or epithelial cancer. Hemorrhage is the earliest, as it is the most prominent, symptom, dysuria and all the other signs and indications of obstructive disease of the urinary passages soon making their appearance. Local pain is tolerably constant, being of a lancinating character, and is referred much to the loins, thighs, and perinæum.

The bleeding is often profuse and sudden, blanching the patient; cachexia soon shows itself, and death from exhaustion, with glandular enlargements in the pelvis and loins.

FIG. 221.

Thickened Wall of Bladder



Microscopic appearance of villous growth

Villous growth in bladder, with hypertrophied walls of the organ. From drawing 368³², Guy's Hosp. Mus.

The urine often contains *débris* of broken-up cancer with the blood, which when found renders the diagnosis certain; but the surgeon should remember that the epithelium of the bladder assumes such variable forms as to compel great caution in coming to any conclusion as to the nature of a growth from isolated cells. Masses of cells or organized tissue are valuable diagnostic signs.

TREATMENT.—Here, as in the villous growths, palliative treatment is alone applicable; opium or other sedatives to relieve local pain and give rest are essential. These remedies are probably most valuable as injections into the rectum, or as suppositories.

The general powers of the patient are to be supported, and everything that can give comfort applied; but no surgical or medical treatment is of any real avail.

Tubercular Disease of the Bladder.—This is a rare affection, although a real one. It is probably generally associated with the same disease of the kidneys or prostate. It shows itself as a deposit of tuberculous matter in the mucous and submucous tissue, and when this breaks down an ulcer exists. It is usually accompanied with symptoms of irritable bladder and painful micturition, this latter symptom being more common when ulceration has taken place. This disease is one of young middle age.

Rest in the horizontal posture is essential in this as in all bladder affections, anodynes, tonics, and nutritious food being of great value. My friend Mr. Poland tells me that, in a case of tubercular disease of the bladder, attended with ulceration (which was under Mr. Aston Key's care when he was a dresser), where the suffering was severe, Mr. Key suggested the propriety of laying the bladder open, as in lithotomy, and thus allow the urine to flow off as soon as it reached the bladder. The patient was, however, too far exhausted from advanced lung disease to allow of its performance. Mr. Key stated that, in another case where the disease had not made so much progress, he should not hesitate in performing the operation. The bladder in this one was found completely stripped of its mucous membrane, and what remained was studded with tubercular deposits. Mr. Key called it *phthisis* of the bladder.

Atony of the Bladder is a local affection; the term is applied to all such cases of want of muscular power in the bladder to expel its contents as take place as a result of over-distension of the organ from compulsory retention, from organic obstruction, or from some cerebral disturbance, fever, &c. It has been often falsely described as paralysis of the bladder; but whereas in paralysis the loss of power is due to a want of nerve supply, in atony it is the result of want of muscular power due to exhaustion from over-stretching. It may be associated with retention or with incontinence, the latter condition showing itself when the bladder is overcharged, the dribbling of urine being mere overflow.

TREATMENT.—Recognizing the cause of atony of the bladder as muscular exhaustion, the treatment consists in giving the organ muscular repose, and this is to be done by catheterism. Where the atony is not very complete, the drawing off of the urine twice a day may suffice to allow the organ to recover its tone, and to act naturally. When the atony is extreme, the introduction of a catheter into the bladder, and fastening it in, may be necessary, the urine being allowed to run away as secreted through a tube fixed on the end of the catheter. In this way the most complete rest is given to the organ.

Where the bladder is sluggish in resuming its functions after the cause has been removed, tonics, such as iron, may be given, with the local injection into the bladder of some stimulant, such as cold water, or diluted

nitric acid, or tincture of iron in the proportion of four to ten drops to the ounce; but catheterism alone is, as a rule, enough, these cases generally recovering unless the cause has been acting for too long a period. When recovery is slow the effects of an electric shock through the pelvis is often beneficial.

Paralysis of the Bladder is a far more serious affection than atony, for the want of power is due to a deficiency in nerve supply, and this deficiency may be partial or complete. It is met with whenever the spinal cord is injured or diseased; in brain shocks or disease, in reflected irritation from disease about the rectum, uterus, &c., and after any operation upon these parts. It may be caused also by a severe mental shock, or the general depression of a fever.

TREATMENT.—The cause of the paralysis must always have an important influence on the practice of the surgeon in these cases, but under all circumstances the necessity of keeping the bladder empty is most essential; for this purpose a soft elastic catheter, of full size, had better be passed two or three times a day, the greatest gentleness being observed in the manipulation. When anything like cystitis is present it should be locally treated by washing out the bladder, &c., as already indicated. To leave a catheter in the bladder is not desirable. When professional aid is not always at hand, a nurse may at times be intrusted with a full-sized vulcanized india-rubber catheter without a stilette, and allowed to pass it; it has simply to be pushed down the penis, and can do no harm. In fever cases the hint is a good one.

Hysterical Retention is not rarely met with in women, and is difficult to treat. Catheterism is only to be resorted to when necessity compels, hysterical patients usually micturating when the pain of retention calls loudly for relief. The cold douche over the lower part of the abdomen is a good local remedy for the affection, and not too pleasant for the patient to wish for its repetition. Moral treatment is always called for in these cases, and medical treatment when demanded.

Incontinence of Urine is met with under two very different conditions. In the one the neck of the bladder, from want of power, ceases to act when the will of the patient is in abeyance, as during sleep, giving rise to *nocturnal incontinence*. In the other the incontinence is only a *result of over-distension*, and is mere overflow. The first form is common in children, the second in the adult. "There is no principle more important to remember in the treatment of diseases of the urinary organs than this, viz., that an involuntary flow of urine in the adult indicates a distended, not an empty bladder" (Thompson). Incontinence, however, both in the child and adult may be due to bladder irritation from the presence of a stone or other foreign body; it will then exist during the day rather than the night; and it may follow the operation of lithotomy from injury to the sphincter of the neck of the bladder.

Incontinence in the child is a very troublesome affection, and often a very obstinate one to treat. It is, however, generally curable, and even in very bad cases as puberty approaches the symptoms disappear. In exceptional instances, the infirmity continues in after-life. The child is generally brought to the surgeon because he "wets his bed," and too often the history reveals the painful fact that punishment has been severely tried before professional advice was sought; it is needless to say that by such a process no cure can be effected, although in many instances the habit is in a measure induced by a want of attention in the parents to take the child up during the long hours of the night. Attention to this point is of primary importance.

When the urine is chemically wrong in any of its constituents, remedies must be given to correct the faults, and a limpid watery urine in a child, as in an adult, is always an irritant; when a long or adherent prepuce is present, circumcision should be performed.

With respect to medicines, the tincture of iron is doubtless the best, and belladonna, either in the form of the tincture or extract, next to it; in some instances the combination of the two is excellent.

I have tried and been disappointed with full doses of chloral, at bedtime. It acts at times wonderfully well, but at others it seems useless. Tonics are the right medicines to give, one form often succeeding where another fails; iron, quinine, nux vomica, and zinc being, as a rule, better than belladonna. The tonics by day, and a night dose of belladonna, have sometimes proved of value.

The bowels should always be looked to, and the presence of worms considered; and it is well to get the bowels relieved at night before going to bed. When the child is not too young, cold baths, with or without salt, should be used, and every means employed to maintain the general health, although it must be added that children who labor under this infirmity are rarely feeble and cachectic.

In cases of extreme obstinacy some surgeons apply a solution of nitrate of silver—ten grains to the ounce—to the neck of the bladder, and they say with advantage.

Others apply mechanical means to prevent the flow of urine, such as an india-rubber ring around the penis, or cover up the urethral or preputial orifice by a layer of collodion; and good reports have been given of these practices. I cannot say I think well of any such means, and have never adopted them; they seem to be wrong in principle. The child should be encouraged to sleep on his side in preference to the back, and for this end a handkerchief with a knot in it may be fastened round the pelvis, the knot being adjusted over the sacrum.

Nocturnal incontinence in a child generally means atony of the sphincter; incontinence during the *day*, bladder irritation, generally a stone or urethral obstruction.

Incontinence in the adult, as already stated, as a rule means overflow, the real condition being one of retention from some obstructive urethral or prostatic disease, bladder atony, or paralysis. It may, however, be due to stone, or the result of a preceding lithotomy. In women it may be associated with some uterine displacement or disturbance; some urethral disease or injury. In men and women severe spine disease may cause it; to treat it the cause must be made out. The introduction of a catheter—as the first means of investigation—is probably a sound practice to follow; it settles at once the question of retention, and often detects the true cause, thus giving a clue to the treatment to be adopted—the removal of the cause.

True incontinence, however, is met with in severe cases of general or local paralysis, in functional derangement of the cord from venereal excesses, and still more frequently from self-abuse; these patients often complain of “inability to stop the flow of urine when commenced.” It is also seen in old people with prostatic enlargement, the third lobe, according to Thompson, being enlarged and projecting forward between the lateral lobes, so as to open out the neck of the bladder and render it constantly patent.

In these cases the use of a urinal is the only remedial means at the surgeon's command, except in the cases caused by venereal excesses, when tonics, cold bathing, and absolute abstinence from all injurious habits may be the means of effecting a cure.

CHAPTER XLVIII.

DISEASES OF THE PROSTATE.

PLACED as the prostate gland is, at the neck of the bladder and the commencement of the urethra, its diseases are of importance; for on the one hand it may suffer as a consequence of urethral disease, and on the other, when affected, it may give rise to bladder symptoms of no mean severity. As a consequence of urethral disease, gonorrhœa or stricture, it may inflame or suppurate, and mechanically interfere with the flow of urine, and thus cause retention; it may undergo nearly complete destruction from suppuration, the direct consequence of stricture, and possibly of extravasation.

When enlarged from hypertrophy, stone, cancer, or any other cause, it mechanically may interfere with the flow of urine, and thus set up bladder symptoms or bladder disease of no slight severity, as it may, by the special direction of the growth of one of its lobes, cause incontinence (*vide* former chapter).

Inflammation of the Prostate is usually due to the extension backwards of a gonorrhœal inflammation or the presence of a stricture. It may, however, arise as a complication of cystitis, from the irritation of a calculus, the passage of a sound, or the application of caustics. It is also not unknown as an idiopathic affection in gouty subjects, and in those who indulge in sexual excesses.

It is generally ushered in with pain in the perinæum and bladder irritation, the act of micturition being attended and followed by pain, and often tenesmus. Defecation ceases to be a pleasurable act, and is attended with uneasiness, sometimes with difficulty, and at last with distress. On manipulating the perinæum a deep-seated fullness will be felt, and tenderness, and on passing the finger into the rectum the prostate will be probably found enlarged, spongy, and painful; rigors will probably form one of the general symptoms, with febrile disturbance, varying in severity according to the acuteness of the affection.

As the abscess advances a throbbing pain at the neck of the bladder will be felt, with a constant desire to go to stool. Retention of urine is almost sure to occur.

If the disease be left alone the abscess will probably burst into the urethra, and discharge itself externally with immediate and marked relief; in other cases it may open into the rectum. It sometimes happens that the abscess is ruptured during the passage of a catheter to relieve retention, or during a rectal examination; this has happened to me on several occasions.

When this disease is *acute* the local symptoms, as well as the general, will be severe; when *chronic*, they will be less well marked, but not less characteristic.

As a result of acute inflammation, chronic disease is often left; pain in passing water, irritability of bladder, a thin urethral discharge, cloudy purulent urine, and perineal, pelvic, and anal pain, increased on exercise or excitement, being the chief symptoms. There may at times be some little loss of power in emptying the bladder, or pain in sexual intercourse, or frequent nocturnal emissions.

TREATMENT.—When the symptoms are acute, few things give more relief than the application of fifteen or twenty leeches to the perinæum, followed by a hot hip bath, and the subsequent use of a linseed poultice made with

the decoction of poppies or mixed with the extract of opium. A good purge should also be employed, and alkalies given, with sedatives such as morphia or opium, to allay pain.

When retention of urine exists a catheter must be passed, but not before the warm bath and opium have been employed, for the introduction of a catheter under such circumstances is always painful, and it may do harm. When called for, an elastic instrument, well softened, and oiled, should be selected. Rest in the horizontal posture should be observed, and liquid diet given.

When an *abscess* has formed, and any evidence exists of deepseated perineal suppuration, an incision in the median line of the perinæum should at once be made; and, indeed, should suppuration not have taken place, the operation will be followed by relief to the symptoms, relieving tension.

When the abscess has opened naturally no surgical interference is usually called for; in exceptional cases, where one abscess is followed by another, and evidence exists of the deep parts about the gland becoming more involved instead of undergoing repair, a perineal incision should be employed. When the suppuration is due to stricture, and probably extravasation, the propriety of dividing the stricture and laying open the perinæum down to the prostate cannot be questioned.

In chronic inflammation, whether the sequel of the acute or not, attended with suppuration, the same practice is to be followed as that already laid down. When no suppuration exists, but only enlargement, counter-irritation, by means of small perineal blisters, is of great use, the elevation of the pelvis with a pillow at night being also of value. Tonics are, as a rule, required, with the iodide of potassium. The bowels should never be allowed to be confined, the use of some saline medicine, probably, one of the natural waters, such as the Vichy or the Pullna, being ordered as a laxative. All mechanical interference with the prostate is to be avoided, and the nocturnal emissions are to be treated on general principles, and not as due to a local cause; tonics, generous living, and fresh air doing more towards hastening recovery than anything else. Over-exercise is to be avoided, and sexual excitement forbidden.

Abscesses occasionally occur around the prostate, and give rise to very many of the same symptoms as a prostatic abscess. They are more apt, however, to make their way towards the posterior part or the perinæum into the ischio-rectal fossa. They should be opened as soon as they are recognized by one or two deep incisions in front of the anus; on either side of the median line. Not long ago I let out by two incisions about a pint of pus that had accumulated in this part, and had produced complete retention of urine for several days. Immediate relief followed the operation, and a good recovery.

Hypertrophy of the Prostate.—This is a general term applied to conditions of the gland not inflammatory, in which a chronic enlargement is the chief symptom; it is generally believed to be a common consequence of old age—indeed, it has been regarded as a general senile change. Pathological investigations have, however, taught us that this is not the case; and Thompson, with others, has clearly proved that, although it is an affection of advanced life, it is in no way a necessary attendant on old age, the vast majority of old men having nothing of the kind.

When present, however, it is usually met with in subjects over sixty. Thompson has never met with an example before the age of fifty-four; and, after many dissections of the prostates of elderly men, he found an appreciable enlargement of the organ in one-third of the cases, but in only one-third of these was it enough to cause symptoms during life.

The disease is generally believed to be an hypertrophy, or overgrowth of natural tissues, and in a certain proportion of instances this is the case; but in others the enlargement is due to the development of distinct glandular tumors, imbedded within the structure of the gland, which may be squeezed out of the organ upon division of the tissues covering them in. They are sometimes merely covered by the capsule of the prostate, at others they are well placed within its structure; at times they are single, at others multiple; and they rarely give rise to any other than mechanical symptoms. When these growths are situated in what is called the third lobe of the prostate, or the central portion that is placed within the bladder, they give rise to symptoms of obstruction and bladder irritation, precisely similar to those caused by the genuine enlargement or hypertrophy of the gland itself. These fibrous or glandular tumors are analogous to those found in the uterus. This hypertrophy is now known to be—as shown by Ellis and others—a mere increase in the natural fibrous and muscular tissue of the organ, the glandular structure of its surface being proportionately increased. The enlargement is mostly general; and as long as the vesical or third lobe is not materially enlarged, and the urethra is not encroached upon, it is extraordinary to what a size the prostate may attain without giving rise to any special symptoms. It is only when the so-called third lobe increases bladder-ways, and by its size, or the direction of its growth, interferes mechanically with the act of micturition, that any marked symptoms are produced. In the preparation from which Fig. 222 was taken this condition is well shown.

The effect of an enlargement of the prostate is very variable; sometimes the prostatic urethra is elongated to twice or more its normal length; sometimes it is tortuous, this condition being caused by an unequal enlargement of the lateral lobes. Under these circumstances, also, the diameter of the

FIG 222.



passage may be encroached upon, giving rise to obstruction; all these changes are, however, urethral. In the bladder others are found, and the most common is the sudden projection upwards of the vesical or third lobe; and when with this, one or other of the lateral lobes is increased, a great irregularity of the urethra is the result. The projection of this so-called third lobe, whether from hypertrophy or from a glandular tumor, is the chief cause of difficulty in micturition, and the main obstacle to the passage of a catheter.

This enlargement of the prostate may so derange the course of the muscular fibres, about the trigone of the bladder, as to produce a bar or ridge that mechanically interferes with micturition; and Guthrie and Mercier have described such a bar as occurring independently of these changes, the bar consisting of the elastic structure and mucous membrane of the neck of the bladder. Thompson also asserts that, in "very exceptional instances, the bar is undoubtedly to be met with." I have never known such a bar as that last described to be found, and give it only on the authority of the names quoted. It is said to be found in younger subjects than prostatic enlargements, and to give rise to similar symptoms. Hypertrophied prostates are sometimes met with measuring four inches in diameter; they are common at half that size; they have been found to weigh ten or twelve ounces; the normal weight of the prostate being four and a half drachms.

Symptoms.—There is little doubt that prostatic enlargement may go on to an extreme degree without giving rise to any definite symptoms, as long as the vesical orifice of the urethra is not interfered with; indeed, very often an attack of retention is the first that attracts notice. On inquiry, however, it will generally be found that the patient has had for some time a difficulty in micturition, the bladder has hesitated to contract when the desire to pass urine exists, and there has been less force than formerly in the expulsion of the fluid. At times the water will have been found to flow in a languid stream.

Irritability of bladder has then appeared, the act of passing urine being rapidly followed by the desire to do so again, and the difficulty of the act gradually increasing.

A feeling of weight and fulness in the perinæum soon appears, and irritation about the rectum; the rectal irritation and irritability of bladder increasing equally as the symptoms progress; the two acts of defecation and micturition will take place together, the violent straining and tenesmus giving rise to prolapse of the rectum or piles, and leading the patient to think that the bowel complication is the cause of his disease, if not the disease itself.

As the disease progresses cystitis will appear with all its effects, as the direct consequence of the bladder being unable to empty itself; a residuum of urine remaining behind, the bladder gradually expands from its accumulation, and becomes exhausted by ineffectual efforts at its expulsion; the urine, at the same time, decomposing and acting as a direct irritant to the mucous membrane of the bladder. From this cause inflammation is produced, and incontinence from the overflow of a distended organ. This incontinence exists both day and night.

The ultimate result of this affection, if left to nature, is the same as that of all obstructive urethral diseases; from the pressure of retention the ureters and kidneys suffer after the bladder, and organic renal disease is set up, the powers of life being gradually sapped by exhaustion, and death being often hastened by severe bladder symptoms, hæmaturia or uræmic poisoning.

The surgeon, on making a physical examination of a patient laboring under this disease, will probably find the bladder more or less distended, and on passing a catheter, after the patient has to the best of his belief emptied his bladder, several ounces of urine will be drawn off; this urine may be ammoniacal, the condition being produced by its partial decomposition from its retention and admixture with the mucus of the bladder. In neglected cases the urine will be fetid, and may contain blood. The passage of the catheter will also reveal the nature of the obstruction at the neck of the bladder.

On passing a finger into the rectum the enlarged prostate will be felt, in some cases nearly filling up the pelvis; when pus or fluid exists in it, fluctuation will be present; when inflammation, pain. The finger should be well anointed, and at the moment of its introduction the patient should be told to bear down. The student should remember, however, that to appreciate any abnormal condition of the gland, it is necessary to be familiar with its normal state.

As a consequence of this affection, and of the change produced in the urine, a phosphatic calculus may form. Its presence is, however, often masked by the symptoms of the disease. When there is increased pain after micturition, pus and blood in the urine, and extreme pain in the penis, its presence may be suspected, and when fragments of phosphatic deposit pass, the suspicion is confirmed. In all long-standing cases of prostatic

disease with bladder symptoms, it is well for the surgeon to think of the presence of a stone, and let him remember, that when present it is often difficult of detection, the stone being protected by the enlarged prostate, behind which it usually lies.

A patient with enlarged prostate is liable to retention from any sudden chill, over-distension of the bladder, mental emotion, or fatigue. Such accidents, indeed, usually reveal the presence of the affection.

TREATMENT.—There is no medicine that has any influence in checking the progress of this disease, or of causing absorption of the enlarged organ; but by way of palliating the symptoms that are the direct result of the enlargement, and neutralizing its evil effects, surgery can do much.

The most essential point is to insure the complete evacuation of the bladder's contents, to see that no residuum of urine remains in the bladder to irritate the organ and decompose, and thus set up cystitis. This is to be done by the passage of a catheter. In early cases, where but little bladder irritation exists, the passage of the instrument, once a day, may suffice; but when the residual urine is in any quantity, and the bladder has lost some of its power of contraction, the introduction of an instrument two or three times in the twenty-four hours may be called for; and in worse cases, where the bladder has lost all power of contraction on account of its over-distension from chronic retention, it may be necessary or expedient to tie a catheter in the bladder, and leave it in for a time. The surgeon must remember, however, that instrumental aid, though valuable, is a necessary evil, and should not be resorted to more frequently than the necessities of the case demand.

Where instruments are required, the flexible are the best, a full-sized catheter being used. When silver instruments are employed, one with a large curve should be selected, the back of the catheter riding more readily over the enlarged vesical or third lobe of the prostate than a shorter one. To assist in the introduction of any instrument into the bladder, the passage of the index-finger of the surgeon's left hand fully into the rectum is an excellent aid; under all circumstances, the pelvis of the patient should be well raised on a pillow.

When an elastic instrument is used, and some difficulty is experienced in riding over the obstruction, success may often be achieved by the withdrawal of the stylet with one hand, and the pressure of the catheter into the bladder with the other, as soon as the end of the instrument has reached the vesical end of the urethra. Force should never be employed, gentle manipulation and care almost always sufficing to secure success.

When the disease is chronic, and the necessity of catheterism is probably permanent, the patient should be taught to pass a gum-elastic catheter for himself; a few lessons and a little confidence are all that is required for success.

When the bladder has lost all power from over-distension, and it is necessary to give the organ complete rest to allow it time to recover its tone, a catheter may be fastened in; and when the instrument causes too much irritation and adds to the mischief, a good compromise may be found in the practice of leaving it in at night and removing it by day.

When the introduction of the instrument is attended with great difficulty, it may be expedient to leave an instrument in for a longer period than under other circumstances.

The vulcanized india-rubber catheter is a good form to employ for this purpose, although at times it causes more urethral irritation than the gum-elastic. Mr. Holt's winged catheter may be employed when difficulties are experienced in keeping in the simpler form.

When retention is present, and catheterism is impossible, the surgeon may be called upon to puncture the bladder per rectum, to give relief. When severe cystitis exists, and the agony of catheterism becomes unendurable, it is a question whether a clean incision into the bladder, as in lithotomy, to allow the urine to flow away, would not be a desirable measure. This, however, is only a suggestion.

With the local treatment of this affection the general must not be neglected, although in importance it is very secondary. When cystitis exists it must be treated upon the principles previously laid down. The general condition of the patient must be maintained by means of good diet and sufficient stimulants. The skin should be kept warm, and all sudden chills avoided; the bowels must be kept open, but not loose; pain should be relieved by sedatives, and sleep secured by hypnotics; tonics are often called for, the preparations of iron being as a rule the best.

When there is no inflammation of the bladder, &c., to forbid it, exercise should be taken, walking and driving being the best forms; and under these circumstances, the local distress from the affection may be rendered very light, and life prolonged with comfort for many years.

Patients with this affection should, as a matter of habit, once a day pass urine on their hands and knees; in this way, the bladder having more power to evacuate its contents, the mucous and other more solid contents that otherwise would lie behind the prostate, are with great certainty got rid of.

Atrophy of the Prostate is often found both in the aged and in the young; in rare cases it is due to some arrest in its development; in the majority it is genuine atrophy, or fibroid degeneration, probably in some caused by syphilis. Such a condition does not, however, give rise to any symptoms by which it can be recognized during life, nor is it a cause of any distress.

Calculi of the Prostate are not rare; they may be found imbedded in the organ as small stones, varying in size from a grain of sand to bodies of much larger dimensions; they are often very numerous; they are sometimes amorphous, but generally laminated. Wollaston says they are composed of 84 per cent. of phosphate of lime, $\frac{1}{2}$ per cent. of carbonate of lime, and 15 per cent. of animal matter.

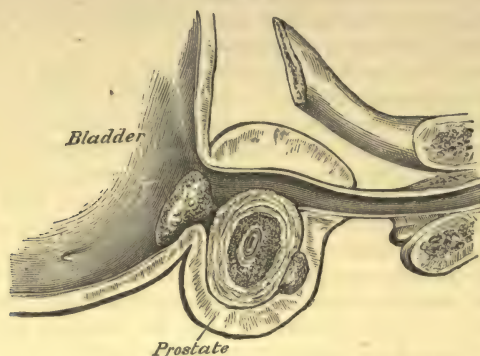
"The prostate gland, like other glands, is liable to an inspissation of its secretion, producing small yellow, sometimes red, pale, or colorless bodies, scattered throughout the follicular structure. These, at first, are said to consist entirely of organic matter, which Virchow believes to be derived from a peculiar insoluble protein substance mixed with the semen; but sooner or later, these formations are believed to irritate the mucous membrane, causing phosphatic depositions, which become incrustated upon the organic matter, and thus the genuine prostatic calculi are found."—*Poland*.

When imbedded in the organ, and not interfering in any way with the urethra, they give rise to no symptoms; when encroaching upon the urinary passage, they may cause obstruction, but will certainly give rise to urethral and, probably, bladder irritation; at times they are accompanied by ulceration and suppuration of the parts around.

A prostatic calculus may project into the urethra, and increase the urethral portion extending backwards into the bladder, forming a prostatovesical calculus. In the Guy's Hospital Reports for 1857, a case recorded by Poland, with references to others, will be found (Fig. 223). The calculus has a dumb-bell shape. In all these cases the urethra is usually pervious; the passage of a sound will, however, as a rule, detect its presence—a grating sensation being experienced in the passage of the metal instru-

ment over the stone, but no ring will be heard. A large prostatic calculus may also be felt per rectum.

FIG. 223.



TREATMENT.—When a prostatic calculus gives rise to sufficient symptoms to indicate its presence, and by its size is likely to prove troublesome, it should be removed by a perineal section—by such an operation as median lithotomy, the incision stopping short of the bladder, when the stone does not involve it. In this way Dr. Barker (*vide* Druit's *Vade mecum*) removed a large stone, nearly five inches in diameter, with success. When the stone or stones give rise to few symptoms of importance, they should be left alone; occasionally they pass naturally per urethram. The greatest argument against operation, unless absolutely essential, is found in the fact that these calculi are mostly multiple, both lobes of the prostate often containing them.

Cancer of the Prostate occurs, although but seldom, and it is generally of the soft kind; indeed, as Dr. Walshe stated in 1846, "the evidence of the occurrence of true scirrhus of the prostate is defective." The symptoms are those of enlargement; they, however, increase in severity more rapidly, and the disease is attended with more frequent and profuse hemorrhage than the ordinary hypertrophy. The blood occurs after the straining attending the act of micturition, and appears as pure blood; after catheterism it is often profuse. The disease may be a primary one, but it is commonly secondary. It will not exist for any time without giving rise to glandular enlargements in the groin or along the iliac vessels; and the patient's powers, as a rule, rapidly yield.

The *treatment* is only palliative, the surgeon dealing with symptoms. All instrumental interference should be of the gentlest kind, and as little as possible. Pain must be relieved by opium, and the general powers maintained by good nourishment and stimulants.

Tubercle of the Prostate probably only occurs as a part of a general tuberculosis; and, until the deposit is breaking up, or by its presence is producing some suppurative action, it gives rise to no symptoms by which it can be recognized. It is too often associated with renal or bladder disease, and the local prostatic mischief is lost in the more general affection. It is quite possible that some of the cases of so-called idiopathic abscess of the prostate are the result of the breaking down of this deposit; but there are no clinical data to enable the surgeon to diagnose the presence of this disease, and there are, consequently, no rules other than general ones of treatment to be mentioned.

CHAPTER XLIX.

URINARY DEPOSITS, ORGANIC AND INORGANIC, AND URINARY CALCULI.

BEFORE passing on to the subject of stone in the bladder, it appears desirable to consider, although briefly, that of urinary deposits, organic and inorganic; for the value of a sound knowledge of what the urine may contain, either in *suspension*, *solution*, or *precipitation*, is as great to the surgeon as to the physician, and is as indispensable for successful practice.

The student should remember that healthy urine is a clear, acid, amber-colored fluid, with a specific gravity of 1020 to 1030; that in 1000 parts, 954.81 are water, 45.19 solid matters.

These solid matters are made up as follows: urea, 21.57; uric acid, 0.36; extractives, such as creatin, creatinin, xanthine, hippuric acid, ammonia, sarcine, pigment, unoxidized sulphur, phosphorus, mucus, &c., 6.53; chlorine, 4.57; sulphuric acid, 1.31; phosphoric acid, 2.09; potash, 1.40; soda, 7.19; lime, 0.11; magnesia, 0.12.

He should also remember that, after drinking or after a meal the urine is altered by the nature of the diet, and probably diluted; and that the best sample of urine to examine is that passed in the morning before breakfast; the "*urina sanguinis*" of Prout; when this urine contains any ingredient in excess or in deposit, some important derangement of the system exists. When any of the constituents of the urine are in excess, the balance which normally exists between them, and that keeps them in solution, is disturbed, and, as a consequence, some deposit takes place; when this excess consists of the *saline* salts of the urine, such as those of potash or soda, urinary deposits and stone are less liable to form on account of their solubility, than when the excess is found in the alkaline earths, for the salts of lime and magnesia are most insoluble, and, consequently, when in excess, soon show themselves as gravel or as calculi. For the same reason, uric acid, being a very insoluble constituent, is a very common urinary deposit, and is a constituent of most stones. When blood or pus is found in the urine the surgeon has to make out its source. Is the origin of the blood urethral, prostatic, vesical, or renal? Has the pus been secreted by the bladder, or been poured into it from the kidneys or other part of the urinary tract? Is the salt the result of some excessive supply of its chemical constituents, some deficiency in the working power of the machinery of the body, or some accidental circumstance? Are the kidneys themselves at fault? or is it that they are called upon to excrete morbid products, which have accumulated in the blood from organic or functional disturbance of other portions of the body upon which the existence of healthy blood depends?

All these points have to be determined in dealing with any case of urinary deposit; and in the special works devoted to the subject will be found all that is needed to guide the student.

What I want to impress here is, that urinary deposits are not of themselves diseases, and are not to be dealt with as such; they are always to be accepted as indications of disease, functional or organic, in some of the working organs or other parts of the machinery of the body.

The reader is referred for all special information on these points to the works of Bird, Beale, Owen Rees, Bence Jones, Thudichum, Vogel, and Hassall.

Healthy urine ought to be quite clear; it may, however, be slightly hazy from mucus, or from the deposition of urates in cold weather without being abnormal. When any deposit has been merely suspended in the urine, it will commence to precipitate as soon as the urine has passed; and these deposits are mostly organic, derived from the kidneys themselves or urinary passages. They may consist of *epithelium* cells, columnar or tessellated, from those parts, with more or less mucus. *Vide* Fig. 224.

Blood-corpuscles or clots, crystals of hæmatin, or *pus-cells* may be found.

Renal Casts.—Waxy, granular, oily, bloody, or purulent. Fig. 226.

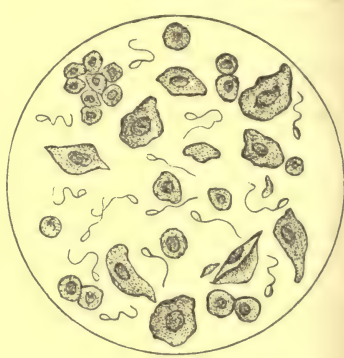
The urine under all these circumstances is albuminous, and the best test for albumen is by boiling and the addition of nitric acid. At times the debris of *kidney structure* may be found or *cancer products*.

FIG. 224.



Epithelium from urinary passages.

FIG. 225.



Spermatozoa and vaginal epithelium.

Spermatozoa (Fig. 225), sarcinæ, or hydatids may, likewise, be present. All these materials can be made out only by the microscope.

Urine containing *blood* is either *red* or *smoky*; that containing *bile* dark

FIG. 226.

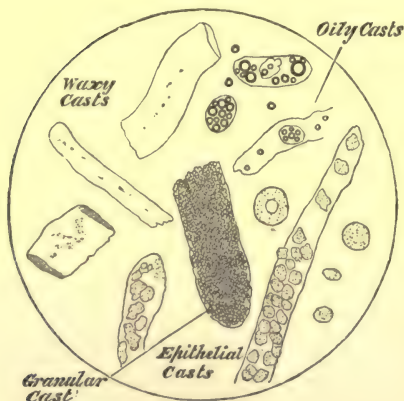
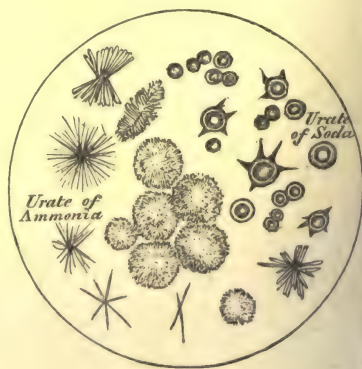


FIG. 227.



or olive brown. *Black urine* is commonly the result of the poisonous absorption of carbolic acid.

Pus, when poured into the urinary passage, has usually little mucus

with it; that secreted by the bladder is mixed with much. Purulent urine is always albuminous.

The *urates* generally appear as "brickdust" or "red gravel" deposits. When they do so, as soon as the urine has cooled down, there is generally some diminution in the watery constituents of the urine and febrile disturbance. When they are deposited some hours after micturition, increased acidity of the urine is indicated from changes in the pigment or extractives, the acids being probably the lactic, acetic, and butyric. A drop of acid added to such urine will precipitate the settlement of the deposit (Fig. 227). They are dissolved by heat and alkalies.

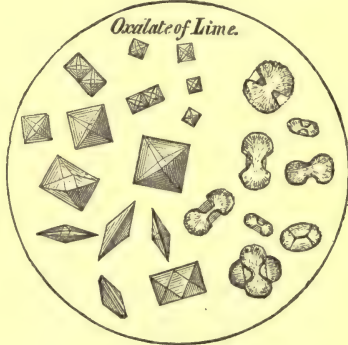
Uric Acid appears in transparent urine of a yellow color, and it is usually deposited slowly. The crystals are variously formed, being mostly rhombic with the angles rounded off or lozenge-shaped. (*Vide* Fig. 228.) They are soluble in potash or soda, insoluble in mineral acids.

Oxalate of Lime is probably secreted under the same circumstances as the uric acid, and has the same pathological signification. Dr. Parkes holds this view, and believes that it may be a substitution for the excretion of the carbonic acid of the lungs. It appears as octahedral crystals or dumb-bell-like bodies (Fig. 229), which are insoluble in acetic acid and

FIG. 228.



FIG. 229.



alkalies, although soluble in the mineral acids, such as the nitric, without effervescence.

The **Phosphates** appear as the ammoniaco-magnesian phosphate, the phosphate of magnesia, and the phosphate of lime.

The first occurs in the form of beautiful, colorless, transparent prisms, or in foliaceous or stellar prisms. It is supposed to be deposited as a consequence of the decomposition of urea, and is first seen upon the surface of the urine as an iridescent pellicle (Fig. 230).

It is soluble in acetic acid, but not by heat.

The phosphates of magnesia and lime occur as white gravel, usually amorphous, at times crystalline. They are mostly found in alkaline urine mixed with pus or mucus (Fig. 231). They are insoluble by heat, but soluble in acetic or the mineral acids.

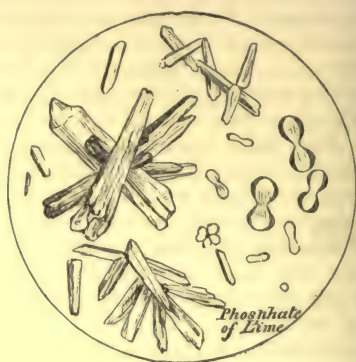
Tyrosine appears in the form of fine needles or stars of a greenish-yellow color (Fig. 232). When treated with nitric acid, urine containing it becomes of a deep orange color, and on evaporation becomes deep yellow. A solution of soda dropped upon this flake produces a red tinge.

Cystine occurs in colorless hexagonal plates (Fig. 233), or light fawn-colored amorphous deposit; it is soluble in ammonia and hydrochloric acid, insoluble in acetic acid.

FIG. 230.



FIG. 231.



Heat only dissolves the urates of the urine.

Potash dissolves all deposits except the phosphates and oxalate of lime.

Hydrochloric acid dissolves all except uric acid.

When any of the inorganic deposits just described mass together either by themselves upon any nucleus of organic matter, such as blood or a foreign body, a stone is the result. This stone may form in the kidney and

FIG. 232.

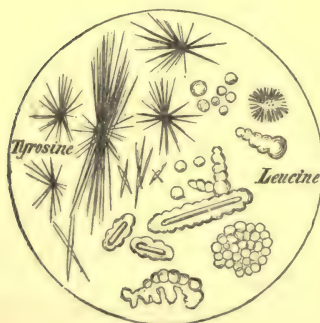
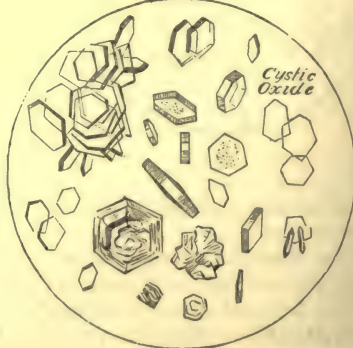


FIG. 233.



remain there; it may pass into the bladder and be emitted with the urine, or rest there and increase; or the calculus may have its origin in the bladder, either from the precipitation of the earthy constituents of the urine, or from the irritation of a foreign body introduced from without. A stone having a renal origin and resting in the bladder, seems to have the power of extracting from the urine its inorganic elements, and thus rapidly to increase; oxalate of lime, urate of ammonia, uric acid, phosphate of lime, or triple phosphate, being precipitated by its presence, and aggregating or crystallizing upon its surface. It acts, moreover, after a time, as a foreign body, sets up bladder irritation, and, as a consequence, the phosphatic salts are deposited from the decomposition of the urine, for Dr. Owen Rees has

shown in his "Croonian Lectures," 1856, that where irritation of the bladder exists either from a calculus, foreign body, or other cause, the mucous membrane secretes an alkaline fluid that tends to cause a precipitation of the earthy phosphates, and thus the formation of a phosphatic stone deposit or crust upon a calculus.

Renal Calculi are generally composed of uric acid, urate of ammonia, or oxalate of lime, and Beale states that microscopic renal calculi of phosphate of lime are by no means uncommon. These concretions may be either impacted in the uriniferous ducts, lodged in pouches connected with the ducts, and increase in the structure of the kidney, or passed into the pelvis of the kidney; they may be single or multiple; they may be the size of a hemp-seed, nut, or walnut, or they may be so moulded to the divisions of the pelvis of the organ as to assume an arborescent shape, such as that figured here (Fig. 234). There is reason also to believe that renal, like a vesical calculus, may form upon a nucleus of blood the result of an injury.

When the stone is fixed in the structure of the kidney its presence may be indicated by few, if any, local symptoms. When it moves about in the pelvis of the kidney it gives rise to symptoms known as those of *nephritic colic*; paroxysmal lumbar pain, with nausea, vomiting, or collapse, irritability of bladder, at times painful micturition and hæmaturia being the chief symptoms.

When the stone passes into the ureter all these symptoms are aggravated, pain shooting down the groin, thigh, and scrotum of the affected side, with retraction of the testis, and these continue till the stone reaches the bladder, when a sudden relief is felt.

When calculi accumulate in the kidney and increase in size inflammation of the kidney may ensue, suppuration, and even its entire destruction; but it is remarkable to what an extent one kidney may be destroyed by the presence of a calculus without giving rise to any symptoms. On the other hand, severe symptoms may appear, and then subside, either to reappear months or years later, or not at all. A stone is occasionally impacted in the ureter, not rarely at its vesical orifice; it gives rise to renal symptoms by obstruction, &c.

When a stone reaches the bladder it may pass with the urine into the urethra and there become fixed, causing obstruction, or escape externally; or it may rest in the bladder and increase, requiring surgical treatment.

It is probable that most vesical calculi have a renal origin, that is, that some small nucleus either of uric acid or oxalate of lime forms in the kidney and passes downwards into the bladder, and the urine supersaturated with these constituents throws them down upon the renal calculus, and thus rapidly adds to its dimensions. Stones thus formed have been called *primary calculous formations*.

Stones formed upon foreign bodies introduced from without are mostly of a phosphatic nature, and when urine is retained in the bladder and undergoes decomposition, either as a consequence of cystitis following paralysis, diseased prostate, urethra, or local irritation from a calculus, a new growth or foreign body, the earthy salts are thrown down and phosphatic calculi or deposits take place, such deposits being known as *secondary calculous formations*. How far these may increase so as to form stones by themselves is

FIG. 234.

 $\frac{1}{4}$ nat. sizeGuy's Hosp. Mus., Prep. 2077²⁴.

an open question ; it is possible that some nucleus of other origin is necessary for the phosphatic deposit to be precipitated upon.

All these chemical constituents, however, require to be held together by a kind of cement: "Marcet referred it to the mucous secretion of the bladder; Fourcroy and Vauquelin to albumen, and sometimes to gelatine with an admixture of urea; Berzelius, however, could not determine whether it was composed of fibrin, albumen, gaseous matter, or mucus; Brande considered it to consist of a mixture of gelatine with urea; Scharling holds that the smaller calculi are always enveloped by a layer of mucus, albumen, or some other organic matter, the flocculi of which entangle and ultimately determine the crystallization of the more insoluble ingredients of the urine; and Dr. Hoskins, as quoted by Gross, extends this view to the minutest particles of the concretion." Coulson.

Urinary calculi, says Poland, may be arranged, like the deposits, into two distinct classes. The *first* will include calculi of *uric acid* and the urates, with their modifications, the oxalates (Dr. G. O. Rees regarding the oxalate of lime as uric acid or urates, altered after secretion), *xanthic* and cystic oxide; the *second*, the phosphatic calculi. A *third* class may be added, consisting of the rare calculi of carbonate of lime, the fibrinous, the ureo-stalith, and the siliceous formations, other chemical ingredients being present, such as organic matters, carbonate of magnesia, silica, oxide of iron, benzoate of ammonia, oxalate of ammonia, phosphate of iron, urea, &c. The oxalates are the heaviest stones, the phosphates the lightest and the largest; few stones exceed an ounce in weight. Coulson, however, records one over six pounds. Recent calculi contain moisture, and are consequently heavier than old. Stones vary in shape according to their position. Thus, *renal* calculi are generally irregular, often arborescent, those in the *ureter* elongated, approaching a cylindrical form. *Bladder* calculi, when single, are more ovoid and flattened, when multiple faceted. The mulberry stone or oxalate is always tuberculated, mostly globular and hard; the uric acid and urate calculi are smooth and regular; the phosphatic irregular, of odd shapes and soft. The dumb-bell calculus is usually a prostatico-vesical or an encysted one.

The color of a calculus is no good guide to its nature, for all calculi, when associated with bladder irritation and ammoniacal urine, become covered with a white coating of phosphatic deposit. A uric acid stone is, however, usually fawn or brown colored, urate of ammonia cinder-gray, oxalate of lime brown or blackish-green, xanthic or uric oxide cinnamon-brown, cystic oxide a gray-greenish hue.

Phosphatic calculi are often horribly fetid and ammoniacal, as are other forms when covered with a like deposit. They are commonly soft and friable.

The *section* of a calculus reveals its structure, and whilst some appear homogeneous, the majority display concentric layers of different degrees of thickness, exceptional examples displaying fine lines of a crystalline form, radiating from its centre; this is well seen in the cystine calculus (Fig. 238).

The different layers of a calculus may have the same composition, or they may differ widely, the latter being known as *alternating calculi*; but any single layer is generally composed of several ingredients. "It is probable," says Odling, "that if a very exact analysis were made, each of the layers of nearly every calculus would be found to contain uric acid, alkaline urates, phosphate of lime, and ammonio-phosphate of magnesia, with or without the other constituents of calculi. Moreover, most calculi contain traces of all the salts naturally existing in the urine, as well as coloring matter, mucus, &c."

Most calculi are divisible into a central portion or *nucleus*, an outer portion or *body*, and occasionally there is an outside *crust* of phosphate (Fig. 237).

The nucleus may be of the same nature as the body, or differ from it.

It may be of an organic nature, such as blood, mucus, &c., or it may be a foreign body introduced from without (Fig. 239).

1. *Uric acid* calculus is by far the most frequent; it is usually derived from the kidney, and when retained in the bladder becomes a flattened oval stone of a fawn or yellow color, and with a compact laminated structure, occasionally crystalline. The uric acid is generally mixed with variable proportions of the alkaline urates.

The nuclei of most calculi are of this nature. In the catalogue of calculi of the Royal College of Surgeons of England, Plate iv, Fig. 6, there is a drawing in which a uric acid calculus is shown to have formed round a piece of steel. This form of stone is often found in gouty subjects, and generally in the middle periods of life. It is usually associated with acid urine, and such as is prone to deposit the urates.

2. The *urate of ammonia* calculus is not common. In the Guy's Museum there are only seven specimens of it out of 394 calculi. Most compound calculi contain this substance in abundance. They are seldom large, mostly smooth, and of a gray-fawn color. On section they are homogeneous or indistinctly laminated, and have an earthy fracture. They are more commonly found in children, although they have been removed from adults, the Guy's Museum containing a bottle (No. 2213) in which are 142 calculi; these Sir A. Cooper removed from the bladder of one patient; they are cubes, with the edges and angles rounded off, of the color of pipe clay.

The rarity of this form of calculus is probably due to the solubility of the salts.

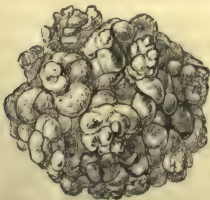
3. The *oxalate of lime* or mulberry calculus is the next in frequency to the uric acid; these calculi are described by Bird ("Guy's Reports," series i, vol. vii) as having an external form of a tubercular, angular, or spinous character, being rarely perfectly smooth (Fig. 236). In color they vary

FIG. 235.

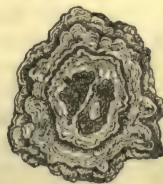


Uric acid calculus, with nucleus of oxalate of lime. Prep. 2193.

FIG. 236.



Mulberry calculus.



Its section.

from gray to a rich brown or black. In some calculi the surface is studded with spines so acute and slender as to resemble thorns; in others there is a

coating of acute octahedrons of transparent oxalate of lime, giving an extremely beautiful appearance. Sometimes these crystals are opaque, and the octahedron is flattened; the calculus then looks as if studded with pearls (Prep. 2139²⁵, Guy's Museum). Sometimes these intervals between the spines are filled with urates or phosphates, giving the stone an ovoid form.

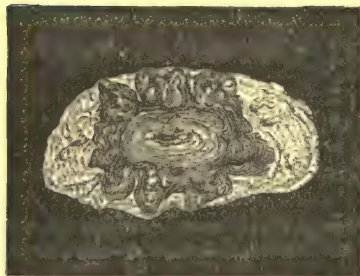
The section of such a calculus is generally that of an imperfectly lamellated structure, the consecutive layers forming waving lines, and often resembling knotted heart of oak (Fig. 236); occasionally there is seen a layer of oxalate of lime arranged round the interior one with great regularity, having a remarkably radiated appearance, like a series of infinitely minute needles placed side by side, and presenting a perfectly porcellaneous structure. In compound calculi the oxalate of lime deposition gives to the character of a stone a remarkably beautiful appearance, resembling that of fortification agate.

The oxalate of lime calculi that have their origin in the kidney (and pass soon after their descent) are usually small, smooth, hempseed bodies.

The crystalline mulberry stone is of a pale brown color, and is composed, according to Dr. Yelloly, of nearly pure oxalate of lime. Poland had a case of this kind in which the stone crumbled to pieces on extraction, from the absence of any binding material of animal matter.

He gives also, on the authority of Mr. C. Williams, of Norwich Hospital, an account of a pure white oxalate of lime calculus. "This," he says, "is of a milk-white color, possesses a highly polished surface, is of extreme rarity, and is generally, if not always, found in the kidney; its external surface presents no crystals, but is perfectly smooth, though it may be spinous. In the museum of the Norwich Hospital are three specimens." The nucleus of a mulberry stone generally contains uric acid (Fig. 237). The body is often made up of alternate layers of uric acid and oxalate of lime. The urine is generally acid. Odd as it may appear, these mulberry stones generally give rise to less bladder

FIG. 237.

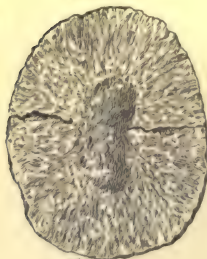


Mixed calculus.

irritation than the smoother forms; possibly they roll about less.

4. *Cystine* or *cystic oxide* calculus is of rare occurrence. Wollaston discovered it in 1810, and the second calculus he analyzed is in the Guy's Museum, No. 2143; it is about an inch in diameter (Fig. 238). It contains sulphur in large proportions, and is a formation of the kidney. Poland points out its hereditary nature, for out of 22 collected cases, 10 occurred in four families, and in these cases the subjects of the complaint were brothers. The calculi are generally rounded or smooth, but may be slightly tuberculated. They have a wax-like lustre, and appear semi-transparent and glistening. When recent, they are of a pale yellowish-brown color, but when kept long they assume a pea-green appearance. Dr. Bird remarks, upon this point, "It has been suggested to me by Dr. Prout and Dr. Willis that this alteration in tint may in some way depend upon changes produced in the sulphur."

FIG. 238.



natural size
Cystic oxide calculus.

Their consistence is soft, and on section they present a very imperfectly radiated structure, and exhibit no tendency to a development of concentric layers; when scraped, they yield easily to the knife, and form a perfectly white powder, whether the calculus be green or brown. The fracture is crystalline.

5. *Phosphate of lime calculus*.—There are two varieties of this form of calculus, writes Poland, the one as described by Wollaston of renal origin, and consisting of neutral phosphate of lime; and these are usually pale brown, with a smooth polished surface, regularly laminated, and the laminae so slightly adherent as to be easily separable into concentric crusts; in some, radiating lines are seen in a direction perpendicular to the laminae: these calculi contain a considerable proportion of animal matter.

The other form is of vesical origin and composed of phosphate of lime, similar to that of bones, and hence often called "bone earth" calculi; they are more common than the former, and constitute irregular masses resembling mortar, or a granular, semi-crystalline powder, enveloped in a tenacious mucus. There are three cases on record in which the phosphatic calculus has been followed by other forms. Foreign bodies, as a rule—and vesical calculi of long standing are such—have the earthy phosphates deposited upon them.

6. *Triple phosphate calculus*, or ammonio-magnesian phosphate, is rare. The College of Surgeons possesses but three specimens, and Guy's only two. No. 2154 in Guy's Museum shows one which has no nucleus, but a central cavity lined with delicate crystals of triple phosphate, resembling the crystals of quartz in the cavities of flints, and No. 2152 is a section of a large calculus of the kind on a nucleus of a tobacco pipe. Fig. 239 represents such a calculus formed round a piece of broken catheter; it occurred in the practice of my friend, Dr. Kitchener.



Fig. 239.

7. The *fusible calculus*, or the phosphate of lime with phosphate of magnesia, and ammonia calculus, is the *most frequent* of the phosphatic calculi. It is generally due to the presence of ammoniacal urine from cystitis, and constitutes the crust that forms on other calculi, or on foreign bodies introduced into the bladder. These calculi increase to a large size; they are irregular, and mould themselves to the position in which they are placed, often filling the bladder. Their color is white, gray, or dull yellow, their consistence friable, and more earthy than any other variety; sometimes so soft as to resemble moist chalk.

Their appearance on section is thus described by Mr. Taylor in the catalogue of the calculi of the Royal College of Surgeons, of England: "They are frequently composed of concentric laminae, which in general adhere but slightly to each other; between the laminae shining crystals of the triple phosphate are often observed; or some of the laminae are entirely wanting, and these form a white friable mass like chalk; in others, they appear semi-crystalline, as if made up of numerous small crystals confusedly aggregated together. In calculi that have a crystalline and glistening texture the triple phosphate is most abundant, while the calcareous phosphate is in excess in those which have an amorphous earthy appearance."

8. The *carbonate of lime calculus* is a very rare form. Thudichum says that prostatic calculi sometimes consist almost entirely of this substance. In Guy's Museum, No. 2187⁵⁰, such a vesical stone exists, of a snow white color, with a nucleus of uric acid. Odling says that calculi which have

undergone partial decomposition in the bladder often contain this ingredient.

9. The *uric* (of Liebig) or *xanthic oxide* calculus, which bears a close relation to uric acid, is as rare as the last. Dr. Marcet detected the substance in a stone of eight grains weight, but no remains of it are at Guy's. Stromeyer rediscovered it in a stone removed by Langenbeck, weighing 335 grains. This stone was laminated, of a bright brown color. A portion of this calculus is in Guy's Museum, No. 2145⁹⁰.

10. The *fibrinous calculus* of Marcet and Prout requires notice. It must be regarded, according to Bird, as a portion of dried inspissated albuminous matter exuded from an irritated kidney. These pseudo-calculi present considerable lustre, and a vitreous fracture.

11. The *uro-stealith calculus* seems to be made up of fatty matter. It has been described in Heller's "Archives," 1844-5, and by Moore in the "Dublin Quart. Journ." for 1854. In Hunter's collection there is likewise a fine specimen of the kind.

12. *Blood calculi* have likewise been described. Marcet has given an account of such, and Roberts of one taken from a sheep by Mr. Lund, of Manchester; all recorded cases were connected with renal hæmaturia. Silica is an occasional ingredient in a stone, as are the urates of soda and lime.

With this brief description of the varieties of stones, for much of which I am indebted to Poland's article in "Holmes's System," it may be well to consider if any diagnosis of their nature can be made before their removal, and for this purpose the character of the urine is of great value.

If it be *acid* the stone is probably uric acid or oxalate of lime, or a mixture of the two; and as the uric acid is more common than the oxalate, probabilities point to it. When the urine contains either ingredient, the nature of the layer that is being deposited is established.

Gouty people, again, are more prone to uric acid than to oxalate calculi.

If the *urine be alkaline from fixed alkali*, as indicated by the permanent change in the test-paper, the earthy phosphates or the carbonate of lime calculi are indicated; if from the *carbonate of ammonia*, the result of decomposition of the urine, the mixed phosphates; that is, that a crust of these is being deposited upon an unknown nucleus.

When a small stone has been previously passed and examined, great help is given towards the formation of an opinion, and also when gravel has been passed.

With respect to the *frequency of stone in the two sexes* the bills of mortality indicate that ten males die to one female from calculous disease, and stone is said to be found in men twenty times more frequently than in women. It is probable, however, that stones form as readily in one case as in the other, but that in women, owing to the shortness of the urethra, and its capability of dilatation, they are more readily passed, large stones being not rarely discharged in the female sex by natural efforts. (*Vide Stone in the Female*, chapter liii.)

With respect to the *ages* at which calculi are most frequently met, the statistics of M. Civiale, Coulson, and Thompson, would indicate that about 60 per cent. of the cases are found in subjects under twenty years of age; 10 or 12 per cent. in those between twenty and forty; 12 to 15 per cent. in those between forty and sixty; and about 10 to 12 per cent. above sixty.

But, in taking these absolute numbers and comparing them with the relative numbers of persons living at the different periods of life named, it would appear that children and young persons are less liable to calculous disorders than has been commonly supposed, and that from twenty years

and upwards the tendency goes on increasing in a very remarkable manner to the end of life; or, as Sir H. Thompson puts it, "that the proportion of elderly calculous patients to the existing population at their own ages is larger than the proportion of children afflicted is to the number of existing children."—POLAND.

Two-thirds of the cases of stone as they come under our notice in hospital practice are in children, and half of these are under five years of age. These young ones are also generally of a healthy and ruddy aspect, and form a contrast to the children admitted for other diseases; the formation and presence of a stone in young life are apparently not incompatible with good health.

CHAPTER L.

STONE IN THE BLADDER.

WHEN a stone finds its way into the bladder from the kidney, it may give rise to few symptoms beyond those of slight urinary irritation. The patient may be conscious by his sensations that a bladder exists, but no more; and when the stone has passed with the urinary stream that sensation disappears.

When the calculus rests in the bladder and increases, it makes itself known by more characteristic symptoms. These symptoms differ widely in different subjects, but, apparently, they have little to do with the nature of the stone.

In some cases—indeed, in the majority—the symptoms are so slight that they are disregarded; and it is too truly the result of experience that, in the larger number of cases of stone, symptoms have existed for many months, if not for years, before it has been deemed necessary to seek advice. The cause of this delay is not, however, in all cases, indifference or carelessness; but it is, in a great measure, due to the uncertainty of the symptoms and the comparatively little inconvenience they cause the patient. It is a rare thing for parents to seek professional advice for children suffering with stone, until some *hæmaturia* has been observed, some prolapse of the rectum has taken place, or the *pain* which the child experiences after micturition, which is generally frequent, has caused evidence of great distress. Upon inquiry the surgeon will then generally learn that for many months the child had been observed to play with the penis after micturition; that the stream had occasionally been interrupted in its flow; and that a frequent call to make water had long existed, with a disposition to drag at the penis.

With these symptoms the presence of a calculus may be fairly suspected; but it can only be on its absolute detection by a sound that its existence can be affirmed. For nearly all the symptoms which have been enumerated can be produced by other and less important conditions; an elongated and adherent prepuce having been already shown to be the chief.

Retention of urine is also another symptom for which the surgeon may be consulted by a patient with stone; and if it be in a child, the probability that a calculus is the cause is very strong. The opposite condition of incontinence of urine is, also, no less characteristic of the presence of a stone in early life; and, when it exists, it frequently indicates the presence of a calculus which has been forming for a lengthened period, and is often connected with organic renal as well as vesical changes.

In adult life, fortunately, the same apathy and indifference to early symptoms is not so common; a man suffering constantly from a frequent desire to pass water, will generally at once seek advice, and if this be the only symptom of which complaint is made, and it has been of some duration, the introduction of a sound is the readiest and best means of proving whether a stone be the cause or not. In some cases this is the only symptom, and it should not, therefore, be disregarded and treated lightly. In others, however, the symptoms which have been already mentioned will be present in different degrees of severity or in different combinations; the symptoms indicating the presence of a calculus varying from the slightest irritation of the bladder to the severest agony. The importance, indeed, of an early detection of a calculus is so great, that it is better in every case of persistently irritable bladder, which is not palpably the product of another affection, to suspect the existence of a stone, and to examine the patient with a sound accordingly, than to run the slightest risk of overlooking its presence, and thus of increasing the dangers (which are always great) of exciting or keeping up organic disease in the bladder, and more particularly in the kidney; for it should be remembered that the presence of a calculus is chiefly dangerous to life from the organic renal changes it is liable to excite; and that the operation of lithotomy is not commonly fatal if no such changes have taken place.

The early detection then of the presence of a stone becomes necessarily a point of the highest importance; the duration of life and the success of any operative measures mainly depending upon the absence or presence of renal mischief; and the excitation of this is chiefly determined by the prolonged presence of a calculus in the bladder.

The confirmed symptoms of vesical calculus in the adult are pain of different degrees of intensity referred to the bladder, aggravated on any sudden movement, and in riding, jumping, or jolting of the body. Pain during the act of micturition, and particularly afterwards, extending along the urethra to the penis, and exhausting straining are often present, as is also the passage of blood. During the flow of urine a sudden arrest of the stream will often be observed, this arrest being followed after the lapse of a moment of time by the return of the flow, and this interruption may be repeated more than once in each act of micturition. Retention or incontinence of urine sometimes complicates the case. Rectal irritation and tenesmus are also frequent symptoms; reflected pains along certain nerves, with or without prolapse, are very constant. Thus, pain in the glans penis is most common, and pain in the scrotum, perinæum, and down the thighs. John Hunter relates a case of stone in which pain in the left forearm was the only indication of a want to make water. Sometimes the bladder symptoms may be severe for a time and then cease, or suddenly appear after any extra exertion. In the former case the stone probably becomes fixed in a sacculus and ceases to irritate as a foreign body; in the latter, it escapes from a sacculus and makes its presence known.

As long as the bladder remains healthy the changes in the urine will be but slight, but when the stone, acting as a foreign body, has set up cystitis, all the symptoms of that affection will appear, with the muco-purulent discharge and ammoniacal urine.

When the symptoms have existed for any lengthened period, the probabilities of renal complication are great; possibly also albuminous urine with lumbar pain and anasarca may appear.

In rare cases a persistent erection of the penis is present.

The symptoms of stone hitherto described are the *subjective* ones; they are those given by the patient; they are possibly suggestive of the affec-

tion, but not conclusive; they may all be produced by other bladder affections. The only conclusive evidence is that furnished by the physical examination of the bladder, by the "sounding" of the patient with a metallic sound or catheter, and the "ringing" of the stone against its end.

For the purpose of sounding a patient suspected of stone the horizontal position should be selected, and it is well to raise the pelvis on a pillow. The bladder should contain a few ounces of urine, if possible, three or four being enough, eight being ample, and the rectum should be empty. When the bladder is empty some few ounces of water should be injected. For a child a small bulbous catheter or sound should be used (Fig. 241), with a short sharp curve. And for the adult a similar instrument is the best (Fig. 240); the hollow steel sound of Sir H. Thompson is a very good one.

FIG. 240.



FIG. 241.

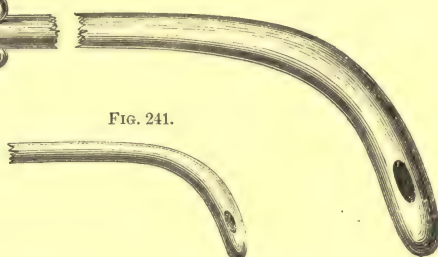


FIG. 240.—Cath. No. 10.

FIG. 241.—Child's, natural size.

Mr. Napier has recently invented a pewter sound, which he oxidizes by applying nitric acid to its surface. When a stone is touched by such an instrument a scratch is produced. For small or light stones this may be of use.

An instrument with a long curve may glide over the stone, and when this is lodged behind the prostate will to a certainty fail to find it; with it, also, the sides of the bladder cannot so readily be explored. The short curved catheter can be made to turn downwards to explore the base of the bladder with the same facility as it can explore the sides. The hollow sound or catheter is better than a solid one, for a stone will often be detected on drawing off the urine from the bladder, when its presence was uncertain before, the bladder in the act of contracting throwing the stone upon the end of the instrument, and making its presence known. The catheter should not have a stilet.

The instrument should be warmed, freely oiled, and passed carefully and slowly into the bladder; its introduction ought not to give pain. It should be at first pushed well home towards the posterior part of the organ to search its base, and then turned first to one side and then the other to search its sides, the sound being gradually withdrawn and again pushed back during the operation.

When an enlarged prostate exists, and no stone has been felt, a suspicion remaining that it may lie in a pouch behind the so-called gland, the beak of the instrument should be turned backwards, and in this way every corner of the bladder may be examined. When no "ring" of the calculus can be obtained, the water may be partially drawn off, and this manœuvre will often insure success. In children the introduction of a finger into the

rectum will at times facilitate the search, and indeed detect the stone, on the pressure of the hand above the pubes.

A large stone is generally touched on entering the bladder near its neck, and a small one usually lies at the base of the bladder, either to the right or left of the median line; an encysted stone is a rarity. A stone may often be felt at one time and not at another; when well-marked symptoms exist any hasty opinion as to its absence is to be avoided.

Besides the presence of the stone, the operation of sounding ought to reveal something as to its size and nature, and probably the number present. The size is indicated by the extent of surface passed over by the point of the instrument; the nature, by the noise emitted on the striking of the stone. Hard stones, such as those of uric acid or oxalate of lime, give a sharp, clear, ringing sound; light and soft calculi, such as the phosphatic, &c., a dull sound. The roughness of the oxalate of lime calculus may also generally be felt. In children, with the finger in the rectum, the size of the calculus may often be readily made out. The character of the urine, as already pointed out, throws some light upon that of the calculus. The value of chloroform in facilitating the searching for a stone, more particularly in children, is so great, that it should almost always be employed. In sounding the surgeon must not be misled by the sensation given by the rugous or roughened bladder, the viscus feeling hard and uneven to the end of the sound, and the examination giving pain. When this condition is made out all sounding should be given up, for the existence of such with a stone is almost unknown.

In children the instrument may strike against the sacrum or spine of the ischium and mislead, but in this case there is no sound emitted; indeed, the surgeon must be careful to *hear* as well as to *feel* the stone before he is satisfied as to its presence, for there are many affections of the bladder and prostate that in their clinical history and physical symptoms simulate those of stone, but in none is any perceptible sound given when using the metallic instrument, as in stone.

In forming a diagnosis the surgeon should always remember that when irritation at the neck of the bladder arises from stone, it is referred to the glans penis; when from disease of the bladder to the organ itself; and when from disease of the prostate to the perinæum or rectum. The only unequivocal sign of calculus is the sound produced on striking the stone.

When a calculus is suspected in the female, a vaginal examination will often enable the surgeon to feel the foreign body; it will also remove all such sources of fallacy as are prone to follow from uterine affections. In female children a rectal examination will do as well.

TREATMENT.—When a calculus has been detected in the bladder, there is but one form of treatment which can be successful, and that is its removal; for, with rare exceptions, a stone, if allowed to remain, will set up not only bladder disease, but kidney mischief, which will end in death.

A stone may be removed by a cutting operation, *lithotomy*; or by a crushing one, *lithotripsy*; the treatment by *lithontriptics* and *electrolysis* has hitherto met with poor success.

In former times small stones were removed from the bladder by forceps. Sir B. Brodie, Sir W. Blizard, Boyer, George Bell, and others have recorded many such cases. Sir A. Cooper's celebrated case, in which he removed eighty small stones by this means, is well known; but the practice has been entirely superseded by the lithotrite.

Lithontriptics, or stone solvents, were used long before the composition of urinary calculi had been made known; they were mostly alkaline remedies; and the most celebrated nostrum of Joanna Stephens, for which the

government of 1739 gave a reward of £5000, was composed of burnt egg-shells and snails, with alicante soap. Prout showed the value of fluid as a solvent in calculous affections; Chevalier, of alkalies; and Ch. Petit, more particularly of the Vichy springs; and there can be little doubt that, in the lithic acid form of stone, alkalies have an undeniable influence in checking their increase, if not in aiding their solution. In other stones they have no such influence.

Dr. Roberts, who has recently paid much attention to this subject ("Med.-Chir. Trans.," 1865), seems to think that "the results obtained by his experiments demand a considerable modification of the prevailing opinion regarding the inutility of the solvent treatment; they suggest an essential improvement in the treatment of *renal* calculi; they indicate that uric acid and cystine, under certain circumstances, are capable of solution in the bladder, by means of alkaline salts administered by the mouth, at a rate which admits of practical application; and that in picked cases a solvent treatment deserves to be resolutely tried." He adds, however, "that the solvent treatment is only applicable in those cases of vesical calculi in which the urine is acid, the stone not large, its composition known to be uric acid, or strongly suspected to be such." The best solvents are the acetate or citrate of potash, sufficient doses being given to make the urine *neutral*, not *alkaline*.

Brodie showed that the injection into the bladder of a solution of nitric acid—two or three minims to the ounce of water—had the power of dissolving phosphatic calculi; and upon this suggestion other experimenters have tried other fluids, such as weak alkaline solutions for uric acid calculi; carbonate of lithia, borax, and acetate of lead, &c.; but there is this great disadvantage in the practice, that the solutions are apt to irritate the bladder, and thus do more harm than good. In the uric acid and oxalate of lime calculi, they are almost useless. In the phosphatic stones most surgeons admit the value of the practice, a solution of diluted nitric acid, ʒij to a pint of water, injected into a bladder where phosphates are being deposited, in many cases being of great value. Such a practice must, however, be carried out with great caution.

The aid of the galvanic battery has been employed to break up stones by Dr. Bence Jones, Sir W. O'Shaughnessy, and others; but the success which has attended the experiments has not been enough to warrant the recommendation of the means.

Small stones may often be washed out of the bladder by means of the urine; and patients who are prone to the passage of renal calculi into the bladder, and to the formation of lithic acid or other gravel, should be directed once a day, when the full bladder is about to discharge its contents, to arrest the flow of urine by holding the penis, and then suddenly to allow the stream to flow; in this way the water passing with a rush, carries away any small stone or sand that might be resting in the bladder. I have known this practice to be followed by good success. Old men should do this on their hands and knees. When a stone is too large to pass in this way, it must be removed, and that is to be done by means of lithotomy or lithotripsy.

Before passing on, therefore, to the operations themselves, it may be well to consider the different classes of cases in which these two operations are respectively applicable.

Stone in the bladder in children may safely be treated by **lithotomy**. It ought to be performed as soon as a stone has been detected in the bladder, for the dangers of any individual case can be fairly measured by the size of the stone and the duration of the symptoms. The longer a calculus

has existed, the greater are the probabilities of renal disease complicating the case; and the dangers of lithotomy, independently of its own special risks, are mostly due to the kidney affection. When the stone is large, the neck of the bladder may be so injured as to set up a fatal peritonitis, and hemorrhage may, in exceptional cases, cause death; but in skilful hands the operation of lithotomy, in patients under puberty, is most successful (*vide* page 501).

Sir W. Fergusson tells us, in his College Lectures, that out of fifty cases of lithotomy in children he has lost only two. In my own practice, out of upwards of twenty-six cases under puberty, I have lost but one, and in that the patient was ten years old; he had had symptoms all his life, and incontinence of urine for four years. The stone was two ounces in weight, and two inches in diameter. He died with peritonitis and extreme disorganization of the kidney.

In children, therefore, it may safely be asserted that success may, with some confidence, be looked for after lithotomy, when performed with care and skill. "It may reasonably be doubted if better can be done before fifteen than cutting for stone."—*Fergusson*.

Lithotrixy, with fine instruments, in exceptional cases may be a justifiable operation in a child, when the calculus is known to be very small; but, as a rule, in patients under puberty, lithotomy ought to be selected. In this country this rule is generally followed; in France, lithotrixy is more often practiced by surgeons.

In stone in the bladder in adults, however, no such general rule can be laid down, although it may safely be asserted, that whenever a stone is found in the bladder of a male adult, its removal by lithotrixy ought primarily to be entertained, lithotomy being had recourse to only when lithotrixy is inapplicable. In tolerably *healthy* subjects, where the stone is small or of moderate dimensions—that is, about one inch in diameter—lithotrixy is to be preferred to lithotomy, as the danger of lithotomy rapidly increases with age, the mortality being one in eight between seventeen and forty, one in four above that age.

"When lithotrixy is employed for stones as large as a date, or a small chestnut—and it is impossible to deny the excellent chance of success which this method offers to the subjects of such stones—a certain, but still only small proportion of deaths must be expected; and the rate of mortality will correspond with augmentation in the size of the stones, and with the amount of existing disease and age on the part of the patient. Given a small stone in a fairly healthy person, and success is certain; the possibility of contingency in such a case depending only on the presence of those remote and excessively rare conditions which will make, for an individual here and there, the mere passing of a catheter a cause of death. In an adult subject, with a urethra of good calibre, and not over-irritable—with a prostate of normal size, or if enlarged, not over-sensitive, or interfering with the passage of the lithotrite—with a bladder fairly healthy, and capable of containing at least four ounces of urine—a moderate stone, and a patient endowed with good health and an ordinary amount of pluck, the operation of lithotrixy may be undertaken with every prospect of success." Such is the opinion of Sir H. Thompson, after 204 operations on patients averaging sixty-one years of age, with only thirteen deaths, or 1 in 15½ cases. ("Med.-Chir. Trans.," 1870.)

When *severe* bladder mischief complicates the case, lithotrixy is out of question, and lithotomy should be selected, although experience confirms what C. Hawkins has stated, that lithotrixy may be performed with success when the bladder has been in a very considerable state of irritation, and

secreting much ropy mucus. The irritation and the secretion of mucus diminish as the operations are performed, and nearly cease before the whole of the calculus has been removed. These cases, certainly, require much caution in their management; still they are by no means cases in which lithotripsy is to be rejected.

When renal disease can be made out to exist, lithotripsy is no more favorable an operation than lithotomy; when associated with bladder complications, the cutting operation is probably the right one to adopt, even if adopted only as a means of giving relief, although, when the stone is small and the renal symptoms are uncertain, lithotripsy may be undertaken with success.

When, however, the surgeon, on passing an instrument into the bladder, finds the urethra narrow and irritable, "the neck of the bladder and mucous membrane particularly sensitive, the prostate somewhat large and so firm in substance that it has been difficult to pass a sharp-curved instrument; the bladder disposed to throw off its fluid contents; the stone large, perhaps more than one, and possibly withal an irritable temperament and a want of moral and physical courage, it is to me," writes Fergusson ("Lect. on Prog. of Surg.," 1867), "very doubtful if the operation of lithotripsy should be resorted to;" although, he adds, it is remarkable how, in some, these conditions become modified by care and "preliminary manipulative treatment."

Paralysis of the bladder does not positively preclude the practice of lithotripsy, although it necessitates extra care and gentleness in manipulation, and may require the mechanical removal of the fragments by a scoop or Clover's apparatus. (Fig. 217.) An enlarged prostate, unless mechanically interfering with the introduction of the instrument, is by no means an insuperable bar to lithotripsy.

"Formerly," writes Aston Key (1837, "Guy's Reports,"), "patients laboring under calculus disorders entertained a feeling of dread, almost amounting to horror, at the idea of having a stone in the bladder. But since the introduction of lithotripsy they no longer entertain the dread of their symptoms depending on the presence of a stone, and when the stone is found they cheerfully make up their minds to undergo an operation, which they regard as free from danger, and nearly so from pain. I have known a patient, and more than one, to be pleased with the discovery of a stone in the bladder, convinced, as he expressed it, that he could look for an easy cure from the new operation. The exaggerated statements of the advantages of lithotripsy have, then, not been unattended with good; they have been the means of inducing persons to come forward to obtain relief when the disease was incipient and the stone small. Since the introduction of lithotripsy the surgeon examines the bladder with great care, knowing the importance of discovering the calculus at the earliest period. The early symptoms of stone are thus watched with more jealousy on the part of the surgeon, and are not so scrupulously concealed by the patient. The advantages of an early knowledge of the existence of a stone, and of prompt measures for its removal, are known to both. The result of this is, that patients apply for advice when the stone is small, the bladder uninjured by its presence, and the kidneys free from disease. In three persons out of four who apply for advice for symptoms of calculus, the size of the stone and the conditions of the viscus render lithotripsy an easy and a safe operation."

These extracts which I have given from Aston Key's paper, written thirty-four years ago, might have been from the pen of a more recent writer. They most accurately represent the advantages of what was then called

the new operation, and prove how the great surgeon who wrote them recognized its value.

It would thus appear that in *children* lithotomy ought to be the rule, lithotrity the exception. In *adults*, lithotrity ought to be the rule and lithotomy the exception, the latter operation being selected only when the former is impossible from some urethral or prostatic irritability or mechanical obstruction, severe bladder disease, or a large stone. Renal disease in all cases renders doubtful the prognosis of any operative procedure, the weight of evidence tending in favor of a cutting rather than a crushing operation under such circumstances, although when the stone is small lithotrity is not precluded.

In cases in which neither operation is to be recommended, or when both are rejected, it is wonderful by care and good advice how long patients, the subjects of stone and organic disease, will at times live, and how little irritation a calculus sometimes causes; and although the knowledge of this fact should not induce a surgeon to leave alone a patient who has a stone, it is enough to enable him to give hope and encouragement to one whose life would be endangered by any surgical attempt at its removal, for palliative treatment is, doubtless, a source of great comfort and a valuable means of prolonging life.

CHAPTER LI.

LITHOTRITY.

"IN the whole of my professional experience," says Fergusson in his College Lectures, 1867, "I know not of a useful operation which has been so shamefully overpraised, and thereby damaged in character, as lithotrity. I know not any process in surgery requiring more forethought, knowledge, manipulative skill, and after-judgment." "Nor is it possible," writes Thompson, "to conduct all the manipulations with too much care and gentleness." These opinions, emanating as they do from the two most experienced lithotritists of the present day, ought always to be remembered, for they are true to a degree that surgeons only who have had some experience in the operation can appreciate. I have placed them, consequently at the commencement of the present chapter. To Mr. Elderton, a Northampton surgeon, is due the merit of being the first to construct an instrument for the purpose of crushing a calculus, and enabling the patient to pass it by the urethra ("Edin. Med. and Surg. Journal," April, 1819); but lithotrity was first realized as an operation and successfully practiced by Civiale in 1824, and to him the profession is chiefly indebted for the operation, although Leroy d'Etiolles, Heurteloup, Amussat, and others did much towards favoring the practice. It is probably, however, to Heurteloup that British surgeons are mostly indebted, for he came over to England about 1829, and explained fully to the profession the mechanism of his improved instruments and the steps of the operation, and on the invitation of Mr. Aston Key this instruction was given in the theatre of Guy's Hospital. Weiss, however, in 1823, had devised a screw lithotrite, and after Heurteloup's visit, and probably from information acquired through him, so improved it that all modern instruments are based upon that then introduced. Aston Key, Brodie, Costello, Hodgson, Fergusson, and others, subsequently

practiced the operation, and upon the result of their experience, with that of Civiale, the operation has become a recognized one, the instruments employed having been vastly improved, and their use better understood.

In 1829 I find Aston Key read a paper on lithotrity at the Hunterian Society, with a successful case, and in the "Guy's Reports" for 1837 will be found a masterly paper upon the subject by the same surgeon. In 1834 Fergusson also wrote on lithotrity in the "Edin. Med. and Surg. Journal," into which he introduced his rack lithotrite, and to him, Sir B. Brodie, Sir H. Thompson, and Charles Hawkins, most of our modern improvements are due.

In the last chapter the difficult question was briefly discussed as to the class of cases in which lithotrity should be selected, and in this the mode of operation, the preliminary and after-treatment, are to be explained. For it may safely be stated that no cases require more careful preparatory treatment than those now under consideration, and more cautious after-treatment.

Starting, then, with the assumption that our patient is middle-aged and healthy; the stone of moderate dimensions, and not too hard; the urethra of normal size; bladder healthy, and well capable of retaining about four or six ounces of urine—conditions under which operative interference ought to be most favorable—it is always well to keep the patient quiet for a few days, and to test the urethra and bladder as to their capabilities of bearing the mechanical irritation of the instrument by the introduction of a sound; attention should be paid at the same time to the condition of the secretions, &c. With every attention, however, it is not uncommon to meet with cases in which the mere passage of a sound is followed by severe local and constitutional disturbance, and in lithotrity such a complication is most detrimental; on the other hand, where irritability exists the occasional introduction of an instrument is often followed by relief.

When the bladder is inflamed and irritated by the presence of a stone, rest is most essential, with the use of alkalies and the decoction of the *Triticum repens*, or other drugs suitable for cystitis. When the urine is ammoniacal the bladder should be emptied and washed out.

By these means the symptoms may subside, and the bladder become capable of retaining sufficient urine—four to six ounces—to allow of the operation being performed, where before it would have been impossible.

"If a stone be small, and it be possible to make away with it at a single operation, I should not mind advising lithotrity on a very brief acquaintance; but if the operation is likely to require two or more sittings, then I should think it wise of the surgeon to test, as it were, his patient's constitution by a repeated preliminary use of a bougie or sound" (Fergusson).

The patient having been prepared for operation by the treatment just laid down, the bowels cleared by a mild aperient or an enema the day before, and with the bladder sufficiently distended, the patient having been directed to hold his urine as long as he conveniently can before the surgeon's visit, the operation may be proceeded with.

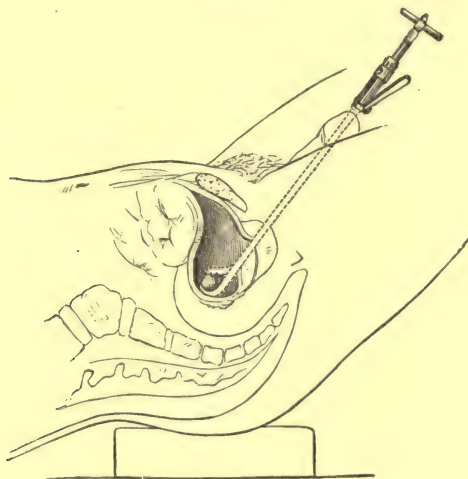
Operation.—The patient should be placed upon a firm horse-hair mattress or sofa, and the pelvis raised by means of a pillow, only such portions of the pelvis being exposed as are necessary to allow of the surgeon's manipulation, for a sudden chill often acts upon the bladder and induces it to contract and expel its contents. The knees should be slightly raised and separated.

The instrument, selected by the surgeon, previously well warmed and oiled, is then to be carefully introduced—no force being employed—the

instrument, indeed, may almost be allowed to fall into the bladder by its own weight, the surgeon simply guiding it.

The bladder reached and the instrument pressed well into the organ, the object is to seize the stone, and this is either to be done by so depressing the lithotrite with its open blades as to allow of the stone falling between them, or by turning the open instrument to the stone and picking it up. The *first* is the older and more usual method, and the one I have commonly adopted; the *second* being useful where the first is inapplicable, where the prostate is enlarged and the stone rests in a hollow behind it. It grows in favor with experience.

FIG. 242.



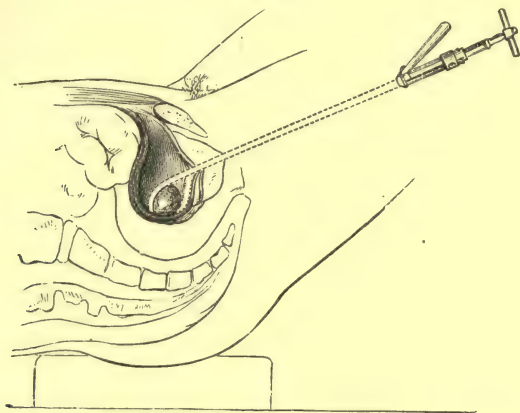
I give the *first*, or *English method* (Fig. 242), in Brodie's words: "The rule for seizing the calculus (which I must acknowledge to have first learned from witnessing the very dexterous operations of Heurteloup) is as simple as possible. The patient lying on his back, the handle of the forceps (lithotrite) is elevated, which, of course, brings the convex part of the curved extremity of it in contact with the posterior surface of the bladder, where it is contiguous to the rectum. The forceps is then to be opened by withdrawing the sliding blade to a greater or less extent, according to the probable size of the calculus, the fixed blade being at the same time pressed gently downwards in the direction of the rectum. The object of this manipulation is, that the forceps, being below the level of the other parts of the bladder, the calculus may fall into it by its own weight, and it is generally successful. If it should not do so, the forceps, without being moved from its situation, may be gently struck with the hand on one side, or on its anterior part, and the slight concussion thus communicated to the bladder will probably be sufficient to dislodge the calculus, and bring it within the grasp of the instrument. If it should be otherwise, the forceps, being closed, may be very gently and cautiously turned to one side or the other, so that the curved extremity of it may make an angle of 25° or even 30° with the vertical line of the body, then opened and pressed in the direction of the rectum in the manner already described."

"When the prostate gland is much enlarged there is sometimes a difficulty in seizing the calculus, arising either from it lying under that part of

the gland which projects into the bladder, or from the impediment which it offers to the elevation of the handle of the instrument. For such cases the operating table invented by Heurteloup, which enables the patient's shoulder to be suddenly lowered, is very convenient; or the same purpose will be answered sufficiently well if the patient be placed on a light sofa, the end of which may be raised by an assistant. The calculus is then seized, not in that part of the bladder which adjoins the rectum, but in the fundus, this being rendered the lowest point by the elevation of the pelvis."

The *second* mode of seizing the stone may be described as that of Civiale. (Fig. 243.) It is thus given by Sir H. Thompson: "Its principle is the re-

FIG. 243.



verse of the preceding. By position of the patient, *the centre of the bladder and space beneath it are selected as the area of operation*; no depression is made; contact between the walls of the bladder and the instrument is, as much as possible, avoided. The instrument is applied to the stone in the situation which this naturally takes, and the operator carefully avoids moving it, or any movements of concussion whatever, however slight. This improved method is in part due to the mechanical improvements which have been made in the lithotrite of late years. The method was scarcely possible until the present instruments existed."

"We shall now consider it in detail. The blades having entered the cavity of the bladder, the instrument slides easily and smoothly down the trigone, which in the living and healthy organ is an inclined plane, although quite otherwise in the atonied and in the dead bladder. In many cases the stone is grazed by the instrument as it passes, and the slightest lateral movement of the blades, right or left, will determine on which side it lies. If so, the operator is careful not to disturb it, but he inclines the blades *slightly away from the side on which it lies*, carrying the instrument gently in towards the posterior wall of the bladder, while the male blade is slowly withdrawn. It is important always to bear in mind that as long as the blades are near the neck of the bladder the male blade cannot be withdrawn, since it would impinge on that sensitive part and cause pain or injury. Having done so, he now inclines the well-opened lithotrite towards the stone, slowly closes, and almost certainly seizes it." "But suppose no stone was felt on entering, he is then directed simply to withdraw the male blade an inch or more in the middle line, to incline the blades to the right side

about 45° , and then to close them, without altering the axis of the shaft, or otherwise disturbing the central position of the instrument. Thus, in almost all positions, the stone is seized sideways by the blades of the lithotrite, and very rarely by their extremities. If no stone is felt, he then turns them, opened, to the left in a similar manner, and then closes them. *Observe, that the blades are always to be opened before they are turned, for this reason—if the turn is first made and the blades are subsequently opened, the chance is that the male blade, as it is withdrawn, will move the stone away; whereas, if the blades are inclined while open, the stone, if there, is almost certainly seized.* This is one of the many apparently minute but extremely important points of which systematic lithotripsy is made up. To return; it is very rare that the stone will elude the search thus far, but if it does, depress the handle of the lithotrite half an inch or so, which raises the blades very slightly from the floor of the bladder, and turn them another 45° to the left, bringing, in fact, the blades horizontally to the left—close; if unsuccessful, turn them gently to horizontal in the right, and close. These five positions—vertical, right and left incline, right and left horizontal, explore the bladder fully, middle, right, and left, and will almost certainly find any stone of moderate size in a healthy bladder. The object is, at the same time, strictly to avoid communicating any jerk to the instrument or to the bladder. In all these movements, if properly executed, there has been barely contact of the lithotrite with the vesical walls; at all events, no pressure, nothing to provoke undue pain, or cause contractions of the bladder. If, however, there is an enlarged prostate, causing an eminence at the neck of the bladder, or depression behind it, or the stone is very small, or we are exploring for some fragment, at the close of the case, which is suspected to have eluded previous search, the blade may be reversed so as to point downwards to the floor, and the object sought may then often be secured with ease. If seeking for a small stone or for fragments, we shall employ a lithotrite with short blades, which can, therefore, be reversed with much greater ease than one with long blades.

“In order to do this properly in the normal bladder, the handle of the lithotrite is depressed another inch or so between the patient's thighs, so that the line of the instrument, instead of being directed obliquely a little upwards, is level with, or even points a little below, the horizon; the blades, supposed to have been already brought to the horizontal, as before described, are cautiously turned about 45° , say, to the right (right reversed incline), so as to point obliquely to the floor, which should be barely felt or very lightly touched by them. No pressure should be made on this part of the bladder by any part of the instrument, and it is easily avoided by depressing sufficiently the handle of the lithotrite; then close the blades; next turn them back, that is upwards, over to the left (left reverse incline), and close. Lastly, they may be brought round to the reversed vertical position, and the floor lightly swept; this requires the maximum depression of the handle, and is only necessary to pick up small fragments with a short-bladed instrument. But when the prostate is considerably enlarged and a stone or fragments have to be sought behind it, the lithotrite is reversed without depressing the handle.

“All these movements are to be executed at or beyond the centre of the vesical cavity, the proper area for operating, without hurry, rapid movement, or any other which partakes of the nature of a jerk or concussion, and, if in a fairly healthy bladder, without causing more than a very slight degree of pain to the patient. The operator's eye is also to be so familiar with the scale marked on the sliding rod, that he knows at a glance the exact interval which it indicates as existing between the blades in the

bladder. It is essential to good practice, while manipulating the lithotrite, to maintain the axis of the instrument as far as possible always in the same direction. The blades only are to be moved; the shaft should occupy the same inclination, unless when this is intentionally altered. In screwing home the small blade the operator is very apt to move the lithotrite also at each turn of the screw, unless he is conscious of the care necessary to avoid the evil. *All lateral movements, all vibration and concussion, necessarily tell on the neck of the bladder and prostatic urethra*, where the instrument is most closely embraced and its mobility is most limited. To that part of the lithotrite which occupies the anterior portion of the urethra much freedom of lateral movement is permitted, and in the bladder the instrument is free, although in a less degree; but the axis or fixed point, as regards lateral movement, is at the part indicated, which is also the most sensitive spot of the entire passage. Hence the aim of the operator should be to produce in this situation no motion of the lithotrite except that on its own axis. Few of the details of the operation require more practice to master than this.

“There is one important rule with reference to the situation of the calculus in the bladder. The larger it is the more certain it is to be found lying near the neck of the bladder in the ordinary recumbent position, while a small one is usually detected at the back of the trigone. This position of the large stone requires a different method, and it will be found almost invariably successful. The moment the lithotrite enters the bladder it is *not* to be pushed onwards to the bottom of the cavity. First, let the blades be inclined away from the side on which the stone is felt, then push on the female portion of the instrument only, by itself, as far as it will go, maintaining the male blade at the neck of the bladder; it is now only necessary to incline towards the stone, and it will be seized almost certainly at once. But if the operator commences by pushing on the whole instrument, and then withdraws the male blade, according to the ordinary custom, the blade is infallibly drawn against the large stone, which it therefore fails to catch, and presses it back against the neck of the bladder, producing pain, irritation, and perhaps bleeding; this is a practical rule of importance.”

Such, then, in the main, is the method of Civiale for finding the stone. It is an admirable one, there can be little doubt, and in skilled hands it is at least equal to the English method. For my own part I have a preference for the English plan, having been originally taught it by Mr. Aston Key, and practiced it since with good success. I have, however, followed Civiale's method when the prostate was large, and the stone failed to fall readily into the open blades of the instrument; also in crushing fragments. In fact, the practical surgeon must understand both methods, and employ one or the other according to the necessities of the case he has in hand. Where gentleness is carried out and the bladder is not pressed upon or irritated by the instrument either method is good; without gentleness and discrimination both are equally injurious. In the English plan the main point to observe is to maintain the female blade as quiet as possible, and sufficiently depressed to allow of the male blade being drawn forward without affecting the neck of the bladder. With this caution a large stone may be crushed with but little pain or vesical irritation; without it the first attempt to open the lithotrite will be resisted by the bladder, and the intention of the operator frustrated.

The stone having been seized—its size gauged by the markings on the handle of the instrument—it is to be crushed, and when the irritation caused by the operation is slight this may be repeated three, four, or more times; under other circumstances one or two crushings are sufficient.

Where the bladder is irritable, the stone of good size, and it is probable that several operations will be required, it is possibly a wise plan to do but little at the first sitting; looking upon it as a tentative step, and, should no bad result follow, the second operation may be more prolonged and effectual.

When the stone is small, one sitting will often suffice to crush it up. I have, however, on several occasions, in healthy subjects with sound bladders, been tempted to crush into fragments at one sitting stones upwards of an inch in diameter, and have had no reason to regret it. Indeed, in this point no general law can be laid down. What may be wise in one case, would be indiscreet in another; what may safely be undertaken under certain circumstances, would be hazardous under others.

In a middle-aged adult, with a healthy bladder and prostate, a large stone may often be rapidly crushed. In an old man with an enlarged prostate the sittings ought always to be short. When the bladder is irritable little should be done at one sitting. When the reverse, more may be undertaken with confidence.

On removing the lithotrite the surgeon should see that the male blade is screwed well home.

With respect to the removal of the fragments opinions differ; most surgeons prefer to leave this to the natural action of the bladder, and to this view my own opinions naturally tend, for I have usually practiced it, but Sir W. Fergusson advocates instrumental interference. "I have generally," says he, "as a first step, introduced a lithotrite of considerable size, equal to a No. 10 or 11 bougie, and broken the stone into various fragments. Next I have taken the smaller lithotrite, attacked these fragments, and then have used a small scoop, with the object of removing several fragments, so that the patient might have satisfactory evidence that the stone had been crushed. In a few days after, the small crusher and scoop have again been used, particularly the scoop, wherewith the fragments, where found sufficiently small, have been extracted singly or two or three at a time. Thus, instead of waiting for the spontaneous escape of the broken portions, a process usually both uncertain and tardy, they have been got rid of by direct and precise surgical interference. By this means a stone may be removed with a rapidity little short of the time needful for lithotomy."

"Occasionally, when over-anxious for a rapid cure, I have extracted fragments rather too large to come readily along the urethra, particularly in the prostatic or membranous portion, or at the triangular ligament. In some, when the urethra nearest the neck of the bladder has been rather roughly used, there has been considerable irritation." But "in many instances I have been able to effect one or two operations within ten days, which, according to custom, would take weeks or possibly months." In paralysis of the bladder this practice is also proved by Fergusson to be of great value; indeed, he states that "such a condition is positively favorable to that process, for there is generally in such cases an apathetic state of the mucous membrane which permits a free use of instruments required for the removal of fragments." That the process must be followed with caution, the experience of the able surgeon I have quoted is a sufficient proof; upon his high authority I now recommend it, having in such subjects had limited experience upon the point.

In the majority of thirty cases of lithotritry that have fallen into my hands I have left the discharge of the fragments to natural processes, and have had no reason to regret it; in all, success followed the practice. In one only had I subsequently to perform lithotomy. Where the prostate is en-

larged and the fragments are prevented from passing, Fergusson's plan of removing them by the scoop or small lithotrite is a good one, and for the same purpose Clover's ingenious instrument (Fig. 217) may be used. It is based on the same principle as one employed by Sir P. Crampton; it is a catheter with a large eye to admit fragments, fitted closely into a glass receiver, and an exhausting india-rubber bottle at the end. I have used this on several occasions with satisfactory success; in one case I adopted the practice I have been in the habit of using for washing out the bladder, employing a long piece of tubing fitted on to the end of the catheter, the tubing acting as a syphon and evacuating the contents of the bladder with great facility (Fig. 219). I am disposed to think this method may be practiced more extensively with advantage. Since writing this I find Professor Dittel, of Vienna, has advocated a like practice ("Practitioner," March, 1871).

The sitting having been brought to a close, the patient should be well covered up in bed, and a tumblerful of warm wine-and-water, or brandy-and-water, given, this practice having a tendency to check the rigor that so often follows the operation. The patient should not make water for some short time afterwards, if possible, and he should then make it in the recumbent posture, care being taken that the chamber into which the water passes is covered with a layer of muslin to catch the fragments.

After twelve hours of the recumbent position, if no unusual irritability of bladder exists, the patient may get up.

The second operation may be performed within three or four days of the first when no bladder symptoms exist; but where these are present, or have become aggravated, a longer interval should be allowed to pass; a week or ten days, however, is, as a rule, enough. The same may be said for all subsequent sittings.

When a fragment becomes impacted in the urethra, and produces retention, it should either be gently pushed back into the bladder with a large catheter or removed with urethral forceps. These fragments not only produce retention, but epididymitis, from irritation of the caput gallinaginis.

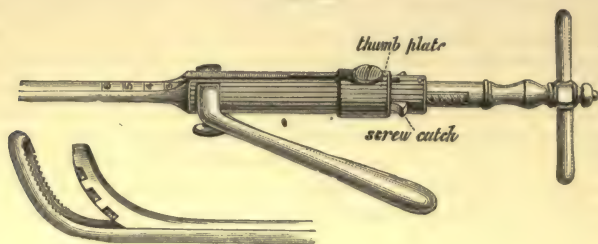
With respect to the use of chloroform in lithotry, there is no doubt that it may be given with great advantage; when the patient has good pluck, there is no reason why it should be administered, but under any other circumstances there is no reason why it should be withheld.

The same care and gentleness should be observed in an unconscious subject as in a conscious one, and with it no more harm to the bladder is likely to accrue.

With respect to the nature of the instruments employed in crushing a stone, lightness combined with strength are the two essentials; each part should work very smoothly upon the other, and the means employed to change the action of the instrument from the sliding movement of the blades to the screw as simple as possible. Civiale originally employed a three-pronged instrument, but at the present time the screw, as originally invented by Hodgson, improved by Weiss, and adopted by Sir B. Brodie, Key, and others, is the more common form of mechanical power employed; but the mode of its application has been in recent times greatly improved, the instruments of Weiss, Charrière, and Matthews supplying us with everything the surgeon can desire. One made by Matthews, of Portugal Street, and figured on p. 500, is the one I prefer; it is based on the movement employed by Charrière and Weiss. He has put a handle to it for my use which enables me, when employing the English mode of seizing the stone, to keep the female blade of the instrument steadier; it can be removed at pleasure. The instrument is worked by the screw, and the change from the

screw to the sliding movement is made rapidly by simply moving the thumb-plate, this plate being fixed in the required position by the screw catches. (Fig. 244).

FIG. 244.



The blades of the instrument may be fenestrated at their ends to facilitate the breaking of the calculus; or flattened and plain, with roughened male blades for powdering or crushing the pieces; both forms are required.

These latter instruments, made very small and slight, have been called scoops.

Sir W. Fergusson still uses the rack-and-pinion instrument he invented in 1834, and it is a very good one. No doubt in his hands it answers every purpose, as it would in any other hands were they to have sufficient practice to render its application easy. It is most important for the surgeon in every case to become perfectly familiar with the instrument he employs; but in lithotrixy this rule is still more imperative, no surgeon being justified in attempting to crush a stone in the bladder of a living patient until by practice he has learned to have perfect command over the instrument he has to employ, and a thorough knowledge of its capabilities. Manual dexterity is only to be obtained by practice; theory is of little value to the lithotritist. For a most complete description of every form of lithotrite employed, and for the history of the operation, the reader must be referred to Sir H. Thompson's admirable work on lithotomy and lithotrixy.

CHAPTER LII.

LITHOTOMY.

IN children, where lithotrixy is inapplicable, and in adults, when lithotrixy ought not to be or cannot be applied, for reasons given in a former chapter, lithotomy must be employed, and lateral lithotomy is the best and most usual operation.

"It is difficult to mention any operation in surgery so uniformly successful as lithotomy is in children. The incomplete development, and the consequently little susceptibility of the parts involved—the small size of the vessels, and the little risk of hemorrhage—the yielding nature of the textures, rendering force unnecessary in the extraction of the stone—are circumstances that combine to divest the operation of much of the danger that surrounds it when performed in the adult. From childhood to the age of puberty the dangers can hardly be said to increase. Boys of thir-

teen years of age suffer scarcely more from the operation than children, and for the same reason. Seeing, then, that so little risk and suffering attends lithotomy in children, it is difficult for us to find an equally safe and efficient substitute; it can scarcely, indeed, be said to be required" (Aston Key).

In the adult male lithotomy is rarely resorted to until the surgeon becomes convinced that the removal of the stone by lithotripsy is inapplicable, or has failed; at least, such has been the practice at Guy's Hospital for many years, and, taking the average of cases of stone in the adult admitted, half only have been subjected to lithotomy. In private practice the proportion of cases of lithotomy to lithotripsy is much smaller, patients applying for advice at an earlier period. From this fact the worst cases of stone are alone submitted to the cutting operation, and, as a consequence, the mortality is high.

"It is probable," writes Birkett, "Guy's Rep.," 1867, "that the rate of mortality after lithotomy must henceforth always appear higher than formerly, in consequence of so many of the patients suffering with stone who might have been cut successfully, being those now selected for the performance of lithotripsy. In point of fact, the very cases which swelled the list of successful results no longer appear in the category of those submitted to a cutting operation; but, on the contrary, those patients too ill to recover from lithotripsy frequently, as a last resource, submit to lithotomy and perish."

At Guy's, lithotripsy being the rule in adults, and lithotomy the exception, the mortality of the latter operation in adults is one in three. Where lithotripsy is little practiced, it is one in five.

Lateral Lithotomy, or the operation of Raw, Jaques, and Cheselden, is, without doubt, the favorite means of extracting a stone from the bladder among modern surgeons, assuming that lithotripsy is inapplicable or unadvisable. As an operation it has been nobly planned; and to see it performed with skill and precision is still a sight which affords gratification to the youngest as well as the oldest surgeon. In my student's days, to see Aston Key cut for stone was an event which I now fondly think over with pleasure and admiration; and the memory of the skill and precision of his acts in this, as in all other operations, is still before me as a standard of perfection to which all should aim.

These remarks are not inapplicable as a preface to the subject of lateral lithotomy; for Key's use and advocacy of the straight staff in lateral lithotomy have so influenced all his successors that up to the present day "Key's" operation is the one usually performed at Guy's, the exceptions to this rule being so rare that they need not be named. The success which has attended this practice has been very good; when, indeed, compared with that furnished from other sources, it seems so remarkable that it is difficult to arrive at any other conclusion than that the mode of operation has something to do with it; for, taking the most reliable statistics—the Norwich 408 cases, and Thompson's 868, eliminating the Guy's cases in subjects under puberty—the mortality was one in every $14\frac{1}{2}$ cases; whilst of Guy's cases and Key's operation during the last fourteen years, 3 deaths have occurred in 131 cases, that is 1 in 44 cases, or three times as good; up to 1862, out of 160 cases I tabulated from the case-books, in which all had not been reported, there had been 8 deaths, or 1 in 20.

In children under five years of age these points are still more strongly marked, for out of 400 cases tabulated by Thompson, the mortality was 1 in every $13\frac{1}{3}$; the Norwich not quite so good; whilst at Guy's, after Key's

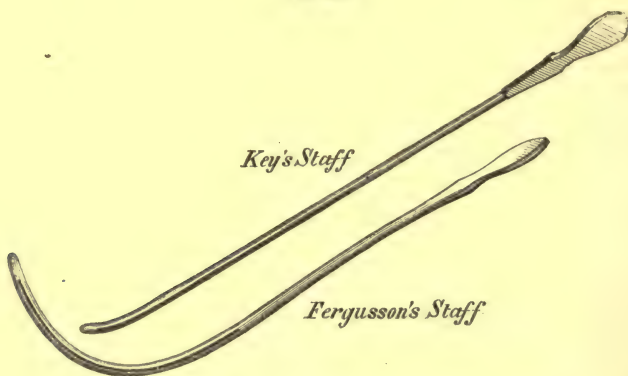
operation, in my old table, it was 1 in $23\frac{1}{2}$ out of 73 cases; and *during the last fourteen years, 70 patients have been cut consecutively without a death.*

This success is certainly striking, more so than I anticipated when I began the comparison, and must in a measure, if not altogether, be put down to the greater safety of Key's operation.

I propose now to describe the operation of lateral lithotomy, and I shall do so after what I believe to be the best method, that of "Key," giving also that with the curved staff. But, first of all, as to the instruments required.

The staff, whether straight, as in Key's operation (Fig. 245), curved as in others, or rectangular, must be regarded as a director; it is a means the surgeon employs to guide his knife into the bladder, and I may say with Key, that "the advantage of a straight over a curved line as a conductor to a cutting instrument is too obvious to require any comment. Is it sur-

FIG. 245.



prising that the blind should err in a crooked path." Key's staff is blunt-pointed, as a sound, and more deeply grooved than the common staff, to prevent any risk of the knife slipping out; the groove is in the centre of the staff, not at one side, as in the ordinary curved one, and it runs to within half an inch of the end. "Its chief superiority," writes Key, "consists in allowing the surgeon to turn the groove in any direction he may wish."

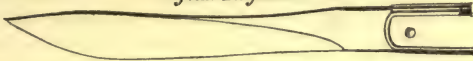
The staff must vary in length and size, according to the age of the patient and size of the urethra, it being well to use as large a one as will pass readily down the urethra.

The **knife** varies much with the fancy of the operator. That employed by Key (Fig. 246) and his successors, resembles in form a common scalpel, but is longer in the blade, and is slightly convex in the back near the point, to enable it to run with more facility in the groove of the director. Different sizes are required for the child and adult. "In the majority of cases it will merely be necessary to pass the knife along the director, and having cut the prostate to withdraw it without carrying it out of the groove, varying the angle according to the age of the patient, the width of the pelvis, and size of the stone. As the direction in which the prostate should be divided, in order to adhere to Cheselden's operation, is obliquely downwards and outwards, increasing the angle at which the knife enters the bladder, will incur no risk of wounding the pudic artery, the knife may be conducted with deliberate care into the bladder, the resistance afforded

by the prostate will be readily felt, and the hand of the operator should be checked as soon as he feels the prostate has given way" (Key).

The knife as employed by Sir W. Fergusson (Fig. 246), is given as a type of that required for the curved staff. Erichsen's knife is very similar.

FIG. 246.

from Fergusson*Key's Knife.*

A probe-pointed bistoury, or blade with a round point, is sometimes of use to enlarge the vesical opening when not made free enough, or to give vent to a large stone.

Lithotomy forceps should be made of several shapes and sizes, and a scoop (Fig. 247) ought also to be at hand. It is used by passing it behind

FIG. 247.



the stone and fixing it there by the pressure of the left index-finger, the instrument, with the two hands, being withdrawn with the stone.

When the perineum is very deep, and some extra guide is required by the surgeon for the introduction of his forceps into the bladder and the extraction of the stone, the blunt gorget (Fig. 248) may be used, the instru-

FIG. 248.



ment being passed into the bladder upon the staff, guided by its beak, and upon this the forceps can readily be introduced.

This is never needed in children, but in adults it is often of use.

The surgeon having decided upon his operation, selected his instruments, and seen that he has at hand everything he may want, having also obtained the help of at least three assistants, beside the chloroformist, four being better, proceeds to place his patient.

A narrow, but well-raised table should be employed, so that the patient's perineum and the surgeon's face should be nearly on the same level. The patient is to be placed on his back with his thighs flexed upon the pelvis, and the legs upon the thighs, the hands of the patient being made to grasp his feet, and fastened in such a position by the figure-of-8 bandage, or, what is better, the padded bracelets and anklets as figured below. The neck ligature is never wanted. Children need not be fastened up, but it is more prudent to do so with adults. Some surgeons, however, since the introduction of chloroform, have given up the practice under all circumstances.

The shoulders should be well raised, the knees separated, and the pelvis kept well down upon the table by two assistants; the surgeon should also

Fig. 249.



see that the patient is quite straight, the line of the umbilicus being the best guide to this position. *The perinæum should be perpendicular.* The surgeon may then pass the staff, and having introduced it well into the bladder, and felt the stone, he is to intrust it to the hands of an assistant—to one who can be relied upon to hold it in the position in which the surgeon has placed it, and not to draw it forwards in any degree. A reliable assistant should be insured, for there is good reason to believe that many of the mishaps connected with the operation are due to the sound having

been partially withdrawn from the bladder by one, who is perhaps stooping forward, trying to get a sight of the operator's movements, and at the same time unconsciously altering the position of the staff.

When the straight staff is used, it is to be held well up, with the handle slightly tilted towards the operator; and when the curved staff is employed, some surgeons like it to be well hooked up against the symphysis, but under all circumstances it is to be held steadily.

The surgeon will probably have seen that the perinæum has been shaved, and before he operates have examined the prostate per rectum and scanned the perinæum. The operator may then proceed with the *first step* of the operation, to lay bare the staff, to expose the groove of the director that is to guide his knife into the bladder; the point at which this opening is desired is *at the membranous portion behind the bulb and in front of the prostate.* Blizard, Martineau, Stanley, Key, and Fergusson all lay stress upon this important point. The perineal incision in lateral lithotomy is usually made on the left side, and the line of incision lies from the left of the median line of the perinæum downwards, backwards, and outwards, midway between the anus and the left tuber ischii. The incision is usually from three to three and a half inches long. Some surgeons commence the cut one inch in front of the anus; others fix it at one and a quarter to one and three-quarters, but this point is not one of primary importance; the object is to make a free external opening to enable the surgeon to reach the groove of the staff at the part indicated, and allow subsequently of the removal of the stone, and a point midway between the scrotum and anus is probably the best guide, the length of the perineal region varying greatly in different subjects.

In making this perineal incision the left thumb of the operator should be firmly fixed above the point at which the knife is to be introduced; and it is well for the surgeon, with the finger of the left hand, to hold the staff firmly at the root of the penis at the same time. The point of the knife may be well introduced into the soft parts in the line of the director, and the tissues freely divided in the cut downwards, a second or third touch of the knife being made to complete the section. Should these be made too low the rectum is liable to be wounded. In this incision the perineal triangle and ischio-rectal space are laid open, and the skin and fascia with the transverse perineal muscle and its artery divided.

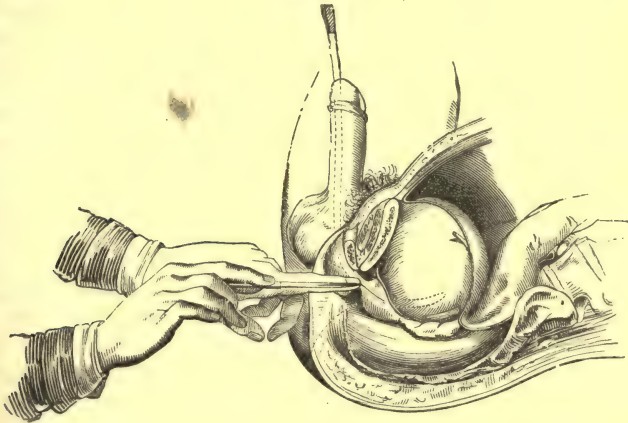
The surgeon is then to proceed to the second step of the operation, and introduce the forefinger of the left hand into the wound, and feel for the

staff *behind and to the left of the bulb*, and having clearly made out the two edges of the groove and fixed his nail between them, he may introduce the point of his knife upon the nail of the finger into the groove, and having clearly divided the tissues sufficiently to make him confident that the point of the knife is well into the groove of the staff, complete his deep section by pushing the knife along the groove of the staff into the bladder, lateralizing it to divide the left lobe of the prostate and neck of the bladder sufficiently. (Fig. 250.)

Fergusson describes the operation as follows:

"The breech should now be brought to the margin of the table, when the assistant who has charge of the staff should be desired to hold that instrument in his left hand, nearly perpendicularly with the concavity of the curve touching the upper part of the triangular ligament, and to draw the scrotum slightly upwards and a little to the right side with his right hand, while he stands on the patient's right side. Then the surgeon should

FIG. 250.

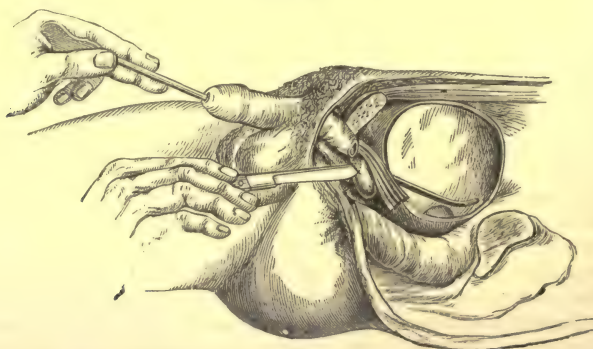


seat himself in front of the perinæum, having previously arranged with an assistant about having the instruments handed to him, or having already assorted them properly in a chair at his side. Now it may be well to pass the forefinger of the left hand, oiled, into the rectum to ascertain the size of the prostate, and also the depth of this organ from the surface; next, having withdrawn his finger, he should trace the course of the ramus of the pubes and ischium on the left side, ascertain the position of the tuberosity of the latter bone on each side, and having scanned the whole surface should proceed to use the knife, holding it as he would a scalpel or bistoury as represented in Fig. 250. The point of the blade should be entered about one inch and three-fourths in front of the anus, about a line's breadth left of the raphe, pushed through the skin and carried by a kind of sawing motion down the left side of the perineum, about an inch and a quarter beyond the anus, the middle of the incision being at equal distances from the latter part and the tuberosity; next the blade should run along the surface of the exposed fat and cellular tissue, and then the point of the forefinger of the left hand should be thrust into the wound a little in front of the anus, so as to penetrate between the accelerator urinæ and the erector penis muscles, the knife being applied to any part which offers resistance, when, with a little force to separate the tissues, the top of the

finger can be placed upon the membranous portion of the urethra, and the groove in the staff may be distinctly felt. The point of the blade, with the flat surfaces nearly horizontal (Fig. 250), should now be carried along above the finger, made to perforate the urethra about three lines in front of the prostate, and then be slid along the groove until it has entered the bladder, having slit open the side of the urethra and notched the margin of the prostate in its course. If the stone is supposed to be of considerable magnitude the blade should, in withdrawing it, be carried a little out of the groove so as to increase the incision of the prostate. The forefinger of the left hand should next be slipped slowly into the bladder along the staff, in such a manner as to cause dilatation of the surrounding textures, and its point should be moved about in search of the stone, which being found should be retained in a position near the neck of the viscus; then the assistant should be desired to remove the staff, and the surgeon should introduce the forceps along the upper surface of the finger, slowly withdrawing the latter as the former makes progress; their entrance will be denoted by a gush of urine, at which instant the blades should be separated, when on gently approximating them the stone will, in all probability, be felt inclosed; if it is not, the process may be repeated if the water still flows, but should the bladder now be empty the closed blades should be quietly moved about the bladder until the stone is touched, and at this time, in opening and closing them, great care should be taken to avoid any injury to the bladder. To make sure that the membrane has not been grasped, it is well to move the forceps a little before commencing extraction, when, if all is right, the process should be effected by a slow zigzag movement in a direction towards the floor, and with a slight pulling force should this be required, as is most likely if the stone be large. Extraction being effected the operation is completed."

In Key's operation, when the groove in the staff has been laid bare, "the point of the knife being kept steadily against the groove, the operator with his left hand takes the handle of the director, and lowers it till he brings the handle to the elevation described in Fig. 251, keeping his right

FIG. 251.



Key's operation of lithotomy. Taken from Key's works.

hand fixed; then with an easy, simultaneous movement of both hands the groove of the director and the edge of the knife are to be turned obliquely towards the patient's left side; the knife, having the proper bearing, is now ready for the section of the prostate; at this time the operator should look to the exact line the director takes, in order to carry the knife safely

and slowly along the groove, which may now be done without any risk of the point slipping out" (Key).

The surgeon knows when he has entered the bladder by the absence of resistance, and occasionally by a rush of urine. He must remember, however, that some urine will escape as soon as the urethra has been opened, and not be misled by the fact. The angle the knife makes with the staff regulates the size of the incision into the neck of the bladder. When the knife is in a line with the staff the incision will be limited; the larger the angle the knife makes with the staff, the larger the wound.

As a rule, a large wound is of no advantage unless the stone be very large. A small wound, however, is a disadvantage when the stone is of medium size; for although the neck of the bladder and the prostate are capable of a good deal of dilatation under moderate force, any severe laceration and stretching are almost certain to be followed by bad results. Surgeons, however, differ much upon this point, some recommending dilatation in preference to free incisions into the neck of the bladder, whilst others prefer free division of tissues rather than run the risk of lacerating them.

Moderate dilatation is certainly free from risk; severe dilatation is dangerous, as it necessitates great laceration. As a rule, a moderate incision into the prostate is better than a free one; the incision, should, however, never exceed the limits of the prostate.

The bladder having been opened, the *third step of the operation* remains to be performed, and that consists in the removal of the stone. This is to be done by means of forceps.

The knife having been withdrawn on the completion of the second step, the index finger of the surgeon's left hand is to be introduced through the wound into the bladder, guided by the staff; and the operator must always remember that, *till the finger has been fairly passed into the bladder upon the staff, this instrument is not to be withdrawn*. When the bladder cannot be reached by the finger, the blunt gorget may be passed along the staff to act as a guide to the forceps. The forceps, held in the surgeon's right hand, is then passed into the wound upon the left index-finger, and, guided by it, pushed into the opening, the forceps being introduced into the bladder at the moment the finger is withdrawn.

"Having delivered his knife to an assistant, the operator takes the staff in his right hand, and passing the forefinger of his left along the director through the opening in the prostate, withdraws the director, and exchanging it for the forceps, passes the latter upon his finger into the cavity of the bladder.

"In extracting the calculus, should the aperture in the prostate prove too small, and a great degree of violence be required to make it pass through the opening, it is advisable always to dilate with the knife rather than expose the patient to the inevitable danger consequent on laceration" (Key).

The forceps should be full-sized, and introduced into the bladder closed *flat upon the stone*, and immediately opened, the stone generally being at once caught in the blades, the rush of urine carrying it towards the wound. The stone is to be grasped boldly, and when seized it is to be slowly and deliberately extracted, the extracting force being made in the direction of the axis of the pelvis *downwards* and backwards and then forwards; a little rotatory and side-to-side motion of the instrument at times facilitates the extraction of a calculus, the surgeon at the same time with his index-finger pushing the soft parts off the stone. Before extracting, the operator, by the sensation given to the forceps, will assure himself that the bladder is not caught.

It is in this third step of the operation that the surgeon often meets with his difficulties, and much discretion and fertility of resource are often needed to overcome them, for no definite rules can be laid down as a guide. The stone may elude the grasp of his instrument; sometimes it clings to the bladder above the wound behind the symphysis, and it is without the reach of the instrument; at others it is caught in the fundus, under which circumstances the pressure of the hand of an assistant above the pubes becomes of value, or the injection of a stream of water. Occasionally, although rarely, the stone may be encysted. At times, when the stone is very small, it may be washed out with the first rush of urine, and consequently not felt. I have seen this happen in a child. At times a bladder may be opened and no stone found; "but from all my experience," writes Sir W. Fergusson, "I feel justified in stating my conviction that most of the cases heretofore related as instances where the incisions for lithotomy have been made, and a stone has not been present, have been examples where the surgeon has failed to reach the bladder." In children this is particularly the case, the surgeon pushing the bladder inwards off the staff. This accident is liable to occur when the neck of the bladder is not sufficiently opened. After the removal of the stone the finger or sound should be introduced into the bladder to ascertain the existence or non-existence of a second.

As soon as the operation has been completed the patient may be unbound. Where any bleeding vessels are visible they may be twisted, but the introduction into the wound of a piece of ice or the application of a cold sponge, with or without ice, to the wound is usually enough to arrest any hemorrhage in children, and in the adult the same practice, as a rule, suffices. When this application is not enough and the hemorrhage is dangerous, the introduction of a piece of sponge into the wound up to the neck of the bladder is a safe practice; it stops bleeding and does not altogether arrest the flow of urine, the water percolating through the sponge. The sponge may be removed at the end of twenty-four hours. My colleague, Mr. Cock, thinks highly of this practice.

Liston was in the habit of introducing through the wound into the bladder a gum-elastic tube six inches long, and fastening it in with tapes, to carry off the urine for the first two days. This practice is still followed by some surgeons; it seems, however, to be quite unnecessary. We rarely use it at Guy's, and Fergusson has quite discarded it. Such a tube is, however, of use when severe hemorrhage ensues, the wound being well plugged around it. Dupuytren employed the same kind of tube, to which was attached a circular piece of oil silk at its centre like an unribbed umbrella, sponge or charpie being introduced between the tube and silk when bleeding took place, after the upper end of the tube had been introduced through the wound into the bladder. Mathews has adapted an india-rubber bag around the tube, which is to be introduced into the bladder empty, and then expanded with air and water. It answers the same purpose as Dupuytren's *canule à chemise*, and is probably more efficient.

In exceptional cases it may be necessary to apply pressure with the finger on the pudic artery to arrest bleeding. When the bulb is cut into this practice is often needed.

When the patient is in bed a good draw sheet should be placed beneath him, and a pillow beneath his knees, to keep them flexed. A sedative to give rest may be employed, and beyond this little or no medical treatment is called for. The diet should be nutritious, but unstimulating, wine and meat being given as soon as the appetite of the patient asks for it. The bowels should be cleared by an enema or mild aperient, such as castor oil, if not naturally acting on the fifth or sixth day, and the horizontal posture

maintained till the wound has quite closed; Key remarking that in children partial incontinence is apt to follow when this rule has not been observed.

The *difficulties* connected with the operation are mostly of the surgeon's own making; they are too often due to carelessness and too great speed. If he *feels the stone* before operating and hears its ring he is sure of its presence; he also knows that the staff is in the bladder, and that he has not passed through any false passage in the urethra, or between the bladder and rectum.

If now *before* cutting he assures himself by touching the staff that his assistant has not displaced it, he has a certain guide down to the calculus. If *when* cutting and proceeding to the second step of the operation he feels with the nail of his left index-finger the two borders of the *groove of the staff*, and cuts with certainty into the groove between them, he still remains sure of his guide into the bladder, and he will not run into a not uncommon error of mistaking the side of the staff for the groove, and going astray. If when running his knife down the director he pushes it sufficiently far to feel all resistance cease, and to cause urine to flow, he may be sure that the bladder has been opened.

And if, on introducing his finger into the bladder, "he never pushes the point of his forefinger onwards unless he feels certain that he has it between the staff and the wound," he is not likely to make a cavity with his finger in the cellular tissue outside the bladder, or push the bladder away, and off the end of the staff.

If he never removes the director or staff till his finger or gorget has been introduced into the bladder, as a guide to his forceps, he is still free from error.

He has now only to handle his forceps boldly, to grasp the stone fully and extract it, always downwards and backwards, and he will complete his operation without a mishap.

The external wound should always be free, the internal limited; moderate dilatation of the neck of the bladder being free from harm.

Should the surgeon, on operating, lose his guide, that is, should the end of the staff slip out of the bladder and he be unable to effect its reintroduction—should the surgeon by some error have missed his staff, and allowed his knife to travel by its side, and thus fail to find the bladder—he had better give the operation up, let the wound heal, and operate again, for without the guide of the director the operation is an impossibility, and all manipulation hazardous.

As long as the staff is in the bladder the operation may be completed. When the opening into the neck of the bladder has been made too small, so as to forbid the introduction of the finger, it may be enlarged, even when the neck of the bladder has been pushed backwards, and the finger seems about to travel into an unknown region. The reapplication of the knife along the groove under these circumstances, and the increase in the size of the wound, will make things clear, and enable the operator to complete his work.

Should the *rectum* receive a *small* wound during the operation, no notice need be taken of it; it is rarely followed by any injurious effect, and, under all circumstances, even when the wound is large, it is well, perhaps, to leave the case to nature. Should it not heal, the case may have to be dealt with as one of fistula in ano, by division of the sphincter.

At times the walls of the rectum may slough after the operation from the injury they sustained during the removal of the stone; but such cases usually do well when left to nature. In my own practice this sloughing took place

after the extraction of a large mulberry calculus, but the case did very well; indeed, no harm or tedious recovery followed.

In elderly patients *prostatic enlargement* may be a cause of difficulty in the operation, and when with this enlargement there is rigidity, the difficulties are increased. The surgeon, under these circumstances, may have to travel far into the pelvis upon the staff to make a sufficient opening into the bladder; when made he may be unable to reach the bladder with his finger on account of its depth, and it is under these circumstances that the blunt gorget becomes of great value, as it can readily be run along the straight or curved staff into the bladder, and thus act as a certain guide to the introduction of the forceps. Martineau was very fond of the blunt gorget in most cases, and I am tempted to think that in adult subjects it might now be used more frequently with advantage.

When the prostatic enlargement encroaches on the bladder, the vesical lobe may be lacerated by the blades of the forceps and torn away; prostatic adenoid tumors may likewise be enucleated. Key noticed this in 1837, and Fergusson has more recently brought the subject forward; and Cadge, in 1862, exhibited two specimens at the Pathological Society. When the outgrowth is in the way it may be cut off with scissors.

When the stone is *soft and friable*, and comes away piecemeal, it is a good practice to wash the bladder well out with a stream of tepid water; and at times, when the stone is apparently held by the bladder in such a position as forbids its being caught by the forceps, a stream of water through the bladder may dislodge it, and allow of its removal.

In *very large stones* a powerful crushing instrument should be at hand, to enable the surgeon to break it up and remove it piecemeal. A short, strong lithotrite is as good as any amongst all that have been invented.

In moderately large stones, when the wound in the neck of the bladder is not large enough, Liston's advice should be followed, and an incision made on the opposite side of the neck of the bladder by passing a blunt-pointed bistoury into the wound guided by the finger, and turning its edge towards the *right tuber ischii*. Martineau tells us that he often enlarged the inner wound two or three times to facilitate the escape of the stone.

Causes of Death after Lithotomy.—When patients die unrelieved with calculus they generally do so from kidney disease, and in the majority of fatal cases of lithotomy the same cause produces a like result. When kidney disease is *not* present any operation for the removal of the stone, when performed with average skill, is likely to be successful. When kidney disease exists, any operation is likely to prove unsuccessful.

These facts are fully illustrated in a paper I read in 1862 (Med. and Chir. Society), on the causes of death after lithotomy.

The longer a stone remains in the bladder the greater are the probabilities of renal disease, and, consequently, the larger the stone the greater the risk.

The duration of the symptoms, and the size of the stone, are, consequently, valuable aids in forming a prognosis.

When death takes place from so-called shock it is probably connected with organic renal disease.

In a small proportion of cases death takes place from hemorrhage; such a result, however, uncomplicated, is very exceptional; probably it does not occur once in a hundred cases.

Pelvic cellulitis and peritonitis have usually been regarded as common causes of death. Pelvic cellulitis is very insidious, and often is only positively made known when some peritoneal complications make their appearance. Its cause has generally been assigned to a too extensive incision of

the neck of the bladder, but the careful investigation of a large number of fatal cases suggests the probability that, although a fatal complication, it is one that for the most part arises without urinary infiltration, as a result of continuity with structures that have become inflamed from injury sustained during the operation, or from the prolonged presence of the stone. It is also commonly associated with renal disease, and it is now well known that under such circumstances the inflammation of serous membranes is very common. It is, consequently, an open question as to how far the renal disease, or the operation, is the cause of the pelvic cellulitis and peritonitis.

Death from acute cystitis may occur, as it may from the hemorrhagic diathesis, pyæmia, chloroform, or any accident.

Uræmia, as a cause of death, is classed with renal disease.

Should a *second stone* form in the bladder, and another operation be demanded, there is no reason why it should not be performed in the same position and manner as the first, and with equal success. The Norwich statistics, as compiled by Mr. C. Williams, indicate this fact very strongly, and even show that a third operation may be performed with like success.

Lateral lithotomy has hitherto been described, and, without doubt, as a general operation it is the best; nevertheless, other operations have been suggested and adopted. Amongst these the so-called **median operation** demands notice. It is the old Italian or Marian method, revived by Allarton. It is performed as follows: The operator first introduces an ordinary grooved staff into the bladder, and gives it to an assistant; he then passes his left forefinger into the rectum, with the palmar surface upwards, as far as the *apex of the prostate*, and holds it there, as a guide to the next step of the operation. He then takes a long straight bistoury, and with its edge upwards introduces it about half an inch in front of the anus, in the median line, down to the membranous portion of the urethra, or apex of the prostate, into the groove of the staff, and presses it towards the bladder for about half an inch; he then cuts upwards, dividing the membranous portion of the urethra freely, and the soft parts of the perineum, making an external wound about an inch and a half long. Through this wound he next introduces a long ball-pointed probe along the groove of the staff into the bladder, and then withdraws the staff. Upon this probe the finger is passed into the bladder with a rotatory movement, the prostatic portion of the urethra and neck of the bladder being dilated; the forceps are then inserted into the bladder, and the stone is removed.

Where the stone is large, Allarton employs Weiss's three-bladed female dilator, or Arnott's hydraulic dilator.

Upon the whole, however, modern experience does not give much support to the operation. When the stone is small, it may be done with safety; but where large, there must of necessity be too much laceration of the neck of the bladder and prostate to render the operation equal to the lateral.

In children the dilating process is a dangerous one, and is apt to be attended by a tearing away of the neck of the bladder from its perineal attachment.

In adult patients, where lithotrity is inapplicable and the stone not large, it may be employed, particularly when any loss of blood is to be guarded against; for it is probably the case that there is less loss of blood in adults by this operation than in lateral lithotomy. In children there is no difference between the two operations in this respect.

The experience of the Guy's surgeons is certainly not in favor of the operation, and that of Norwich in no way tends to give it any support, the mortality of the median being nearly twice as great as the lateral opera-

tion; indeed, it may be stated that, as an operation, it is losing ground in the opinion of most surgeons.

Dupuytren's bilateral section of the prostate, for the removal of large stones, with the semilunar transverse perineal incision in front of the anus, meets with few supporters at the present day. He made his first incision with a scalpel down to the membranous portion of the urethra, and then introduced into the groove of the staff a doubled-bladed curved lithotome, which was pushed, closed, down to the stone, into the bladder along the staff; the blades were then opened transversely, and the instrument withdrawn; by these means the neck of the bladder and prostate were freely incised, the prostatic section having an oblique direction downwards.

Civiale in 1836 suggested his medio-bilateral operation, "being dissatisfied with the bilateral, and shunning the lateral method on account of the anatomical objections."

Having introduced a staff with a median groove, he makes an incision in the median line an inch and a half long in front of the anus, down to the membranous portion of the urethra. He makes a free opening into the urethra, and then introduces an instrument similar to Dupuytren's lithotome, but straight, along the groove of the staff, into the bladder, opening the blades when the bladder has been entered, and dividing the neck of the bladder on its withdrawal. The finger is then introduced, staff removed, and forceps inserted, the stone being removed as in other operations. It differs little from Dupuytren's except in the form of perineal incision.

Sir H. Thompson, who first described this operation in England, and Erichsen, have both removed calculi by this operation with success.

Buchanan's operation with the rectangular staff, bent three inches from the point, and deeply grooved laterally with a posterior opening, is essentially a central operation. He suggested it in 1847. The staff is introduced into the bladder, and, guided by the finger in the rectum, the angle of the staff is made to correspond to the apex of the prostate. The operator, keeping his finger in the rectum, inserts a long straight bistoury in front of the anus, with the blade horizontal and edge turning to the left, down to the groove and angle of the staff, and pushes it towards the bladder to the stop at the end of the staff. He then withdraws the knife, and as he does so makes a curved incision through the soft parts around the left side of the rectum, towards the tuber ischii, the wound being about an inch and a half long. Dr. Buchanan describes his operation as being about half of Dupuytren's; when the stone is large, the right side of the prostate is cut, thus approaching it more nearly as a whole.

The **recto-vesical operation** was at one time a very favorite one. The late Mr. Lloyd, of St. Bartholomew's, was about the last English surgeon who freely practiced it, and now it has almost been lost sight of. The operation consists in the introduction of the knife into the rectum, with the blade flat upon the palmar surface of the index finger, and the perforation of the bowel and urethra at the apex of the prostate down to the groove of the staff. The sphincter and soft parts being freely divided upwards in the median line of the perinæum for about one inch on the withdrawal of the knife, the left forefinger is then inserted into the wound down to the groove of the staff, and the bistoury again introduced with its edge downwards, and pushed into the bladder along the groove, the neck of the bladder and prostate being freely divided when the stone is large. The finger is then passed into the bladder along the staff, the staff removed and forceps passed, the calculus being extracted in the usual way.

As an ordinary operation, this is far inferior to the lateral. König's

statistics, as quoted by Poland, show it to be a very unsuccessful one. When the stone is very large, it may be entertained.

The high operation, or supra-pubic, is one of the oldest; it was practiced by Cheselden and Civiale, and was at one time supposed to be the most direct and least dangerous operation, the only dangerous part being the peritoneum, and that can readily be avoided.

The operation consists of three stages:

The *first* consists in exposing the anterior wall of the bladder, and this is to be done with the patient on his back, pelvis raised, and bladder distended, by a vertical incision made in the median line above the pubes, through the parietes into the subfascial cellular tissue which covers it in.

The *second* step is that of opening the bladder, and care should be observed that this opening is made in the median line and *close to the symphysis*. This is best done by transfixing the bladder where it is exposed, and opening it from below upwards, care being observed that the wound in the abdominal parietes is carefully kept open with retractors.

The *third* step is the removal of the stone by means of forceps.

After the operation the patient should be placed in bed with his legs raised, water-dressings applied to the wound, and the case left to nature.

The practice of introducing a catheter into the bladder through the urethra, and leaving it in, is not considered necessary.

Sir H. Thompson details the plan adopted by Civiale, but it is not so good as the one given.

The statistics of the operation are not very satisfactory. Belmas and Gross give one death in four cases; Civiale one in two; Humphry, of Cambridge, one in three, the age of the patient apparently making no difference in the result.

The cause of death appears to have been peritonitis and infiltration of urine around the bladder.

All these varieties of operations have been detailed, as exceptional cases of stone may be met with in which one or the other may be better than the lateral, but as a general operation lateral lithotomy is the best, and of the two modes of performing this operation Key's is the simplest and most successful.

CHAPTER LIII.

STONE IN THE FEMALE BLADDER.

CALCULI are doubtless formed in the kidney as commonly in the female as in the male subject, and pass downwards into the bladder, although, from the absence of the prostate, the shortness of the urethra and its dilatibility, vesical calculi in women rarely require surgical treatment.

The records of surgery contain many instances in which large calculi have been passed by natural efforts from the female bladder without any very injurious effect resulting, and the experience of every surgeon will supply him with instances in which calculi of moderate dimensions have been readily passed. I have a specimen of mulberry stone, nearly an inch in diameter, which a young woman passed with but little pain, and I have seen many of small size.

In neglected cases of vesical calculi in women the stone may excite

ulceration of the bladder, and its discharge per vaginam; indeed, this mode of getting rid of a stone must be regarded as one of nature's making.

The *symptoms* of stone in the bladder of the female are very similar to those in the male, such as irritability of bladder, pain during and after the act of micturition, intermittent flow of urine, and hæmaturia, a bearing-down pain being a common accompaniment, and incontinence of urine. In the female sex, uterine and vesical symptoms are so closely associated that surgeons cannot be too much aware of the fact, for cases of stone in the bladder are frequently passed over as examples of uterine disease. A vaginal examination, however, will reveal the true state of affairs, for a calculus can be felt by the finger through the vesico-vaginal septum, and where doubt exists the sound will settle the point.

The *treatment* of stone in women is far less complicated than it is in men, the anatomical formation of the parts explaining the fact, and the majority of calculi can be readily removed by urethral dilatation and extraction, or by lithotrity.

The method by *urethral dilatation* is based on the natural one of expulsion, and is applicable in all cases of small calculi. In children a stone three-quarters of an inch in diameter, and in adults one inch, may be fearlessly removed from the bladder by rapid urethral dilatation and extraction; with the patient under the influence of chloroform. I have removed larger calculi, two inches in diameter, by this means, without any injurious after-effect, but it is probably wise not to make the attempt, the surgeon possessing in lithotrity an efficient aid or substitute.

The operation, however, must be done quickly; any *slow dilatation* of the urethra is almost certain to be followed by incontinence, while it is rare to meet with this result after rapid proceedings.

The operation may be performed as follows: With the patient on her back under the influence of chloroform, Weiss's three-pronged dilator is to be introduced, and rapidly expanded sufficiently far to admit the left index-finger of the operator, and then the forceps; the stone, having been seized, may then be rapidly removed. I have on several occasions employed the lithotrite for this purpose, with the view of crushing the stone should any difficulties be experienced in its extraction, and would recommend the practice. On four occasions I have not dilated the urethra at all, but passed the lithotrite or forceps and extracted at once, and am disposed to think this plan is as good as any, for every surgeon must be struck with the facility with which a finger can be introduced into the female bladder, or any moderate instrument, when the subject is under the influence of an anæsthetic.

Should any difficulty be felt in the extraction of the stone, or should it prove a larger one than can be safely removed as a whole, it may be broken up and removed piecemeal; in that way I took away at one operation a calculus an inch and a half in diameter, from a child only four years old, without any difficulty or bad result; and in the year 1869 I successfully removed three calculi from three patients, by these means, with facility. In female subjects there is no such doubt about the wisdom of removing fragments after the crushing operation as there is in males.

When the stone is too large to remove by rapid dilatation, and the bladder too contracted, inflamed, or ulcerated to allow of lithotrity, the stone should be removed per vaginam. In this operation the surgeon—again imitating nature—makes a clean incision into the bladder through the vaginal septum, guided by a director introduced through the urethra; by this means a sufficient opening is made to allow of the removal of the cal-

culus, and its subsequent closure by means of stitches, as in vesico-vaginal fistula, is then all that is required.

I have removed in this way a stone two inches long that formed a complete cast of the contracted bladder with good success. (Fig. 252.) Marion Sims thinks so well of this operation as to assert, "that it is the only justifiable operation for stone in the female bladder," and if by the word operation he means a cutting one he is certainly right, for where the urethra has been divided to allow of the removal of stone incontinence is a common consequence. Dr. Aveling and M. Vidal likewise strongly recommend it.

Urethral Lithotomy is here mentioned only to be condemned, for any incision into the neck of the female bladder is liable, as has just been said, to be followed by incontinence of urine, half of the cases, as a rule, being so affected.

By way of summary it may, then, be concluded :

That a stone of moderate size may be readily removed by immediate extraction, and one of larger dimensions by lithotrity and extraction, the patient being *fully* under the influence of an anæsthetic. That where, from the size of the stone, immediate extraction is not advisable, or from the condition of the bladder lithotrity cannot be performed, vaginal lithotomy is the best operation. That all slow dilatation of the urethra is to be avoided, and all urethral lithotomy condemned, on account of the frequency of incontinence of urine as the result of such treatment.

For further information and statistics *vide* Dr. Aveling, "Obst. Trans.," 1864; and paper by author, "Med.-Chir. Trans.," 1864.

Foreign Bodies in the Bladder.—These are occasionally met with both in the male and female subject. Broken catheters and bougies are probably the most common; but a tobacco pipe, pins, French chalk, slate-pencil, straw, a silver toothpick, penholder, &c., are in the Guy's Museum recorded as foreign bodies that have been removed from the male bladder, and a bone bodkin-case, a cedar pencil, and a stiletto from the female.

Foreign bodies may, however, obtain access to the bladder through wounds, gunshot or otherwise, or through abscesses connected with bone. Brodie has related a case in which he removed a calculus from a young lady which contained "a small portion of bone, and two imperfectly formed human teeth," doubtless the remains of a blighted ovum; and a second, in which a stone from the female bladder had a hazel-nut as a nucleus.

When a foreign body remains long in the bladder it acts as an irritant, and usually rapidly becomes covered with phosphates; but, as already stated, in a specimen at the College of Surgeons a foreign body is the nucleus of a uric acid calculus.

As soon as a foreign body is known to exist it must be removed. Where this can be done through the urethra so much the better; as long as the body is in the passage and is not impacted, this may be done, but when this cannot be effected, and the urethra is the seat of the offending body, a clean incision should be made and the foreign body removed, for incised wounds into the urethra usually heal well, and it is better to make such than to lacerate the urethra by forcible internal manipulation.

In a case I had, some years ago, a long hair-pin was impacted in the penis and perinæum with its points forwards, one end being felt at the base of the penis, imbedded in the tissues beneath the skin. Under chloroform

FIG. 252.

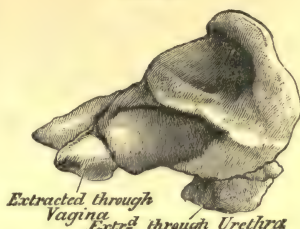


Fig. half natural size.

I pressed the point through the skin, and gradually withdrew the pin, which came out nearly straight. A rapid recovery followed, without a bad symptom.

When the foreign body is in the bladder and cannot be crushed by the lithotrite and drawn out by the scoop, lithotomy must be performed. In adults, possibly, the median operation may be chosen when the foreign body is not large.

In *women*, under the influence of chloroform, the body may usually be readily extracted by means of dressing or other forceps. In the case in which a lady's stiletto was in the bladder of a young woman I found the point of the instrument presenting forwards and upwards, and fixed in the symphysis. With my left finger in the urethra I pressed it back, and after some little manipulation through the rectum with the right index-finger, for

FIG. 253.



the patient was a virgin, I so placed the stilet as to fix the point against the pulp of my left index-finger which was in the bladder, and with a pair of forceps introduced upon my finger, drew it out. The patient recovered rapidly, leaving in a few days without any inconvenience.

With a pair of forceps in the bladder and a finger in the vagina or rectum to manipulate and place the foreign body in a good position for removal, most cases may be treated; the surgeon seizing the foreign body by one end. For the removal of such a thing as a hair-pin, a blunt hook may possibly be of use.

CHAPTER LIV.

STRICTURE OF THE URETHRA.

ANY diminution in the calibre of the urethra, the result of organic changes within its walls, gives rise to *stricture*; any encroachment on the passage from without or within to *obstruction*.

Obstruction occurs when from inflammatory engorgement of its mucous and submucous tissue the urethra is narrowed (the inflammatory stricture of some authors); when from spasm of the urethral muscles the same result takes place (spasmodic stricture); when an abscess outside the urethra or tumor presses upon the passage; when any prostatic enlargement encroaches on the urethra; when any fracture of the pelvis presses upon it; when a calculus or foreign body is impacted in the passage or a urethral polypus is present.

Organic Stricture is caused by the contraction of inflammatory deposit situated upon, within, or beneath the mucous membrane of the canal, or from the contraction of the cicatrix of a ruptured or injured urethra. The first form may be described as *simple organic stricture*. The second as *traumatic or cicatricial stricture*. The former is the more common, my notes yielding 603 cases of the former to 43 of the latter, or as fourteen to one.

In the majority of cases of organic stricture the contraction is of a chronic nature; in some it may be readily traced to a more or less distinct chronic inflammation of the passage; but years will frequently pass away before any obstruction to the flow of urine becomes of sufficient importance to arrest the attention of the patient, and this may at last, perhaps, be first drawn to the part by spasm of the urethra, by a sudden attack of retention of urine, which has been induced by some act of irregularity or exposure to cold.

The obstruction may consist simply of a perforated membranous diaphragm stretched across the canal, or of a narrow band of inflammatory product surrounding the passage, giving rise to the terms "whipcord," "ring," or "annular" stricture. The stricture may be general or only partial, and when the latter, it may have been caused by some adhesion of the natural rugæ of the urethra, or of some folds of its mucous lining; rarer cases are occasionally found produced by bands of lymph forming across the passage, and known under the title of "bridle strictures." When the stricture is more extensive in its nature, there is hardly a limit to the extent of inflammatory deposit which may at times be present, from the narrow band which has been alluded to as forming the "annular" stricture, passing onwards to the broader band which answers to Sir A. Cooper's term of "ribbon" stricture, to the still severer cases in which the urethra is found more or less contracted throughout its entire course. Between these extremes numberless varieties and degrees of mischief may be observed, the urethra presenting one single contraction, or several independent ones; John Hunter mentions a case in which six strictures coexisted. Thompson says he has never met with more than four.

Lastly, the urethra may unquestionably become "impermeable," the pathological specimens in Guy's Museum being enough to demonstrate the fact; such a condition cannot, however, exist uncomplicated with other symptoms, for it is obvious that the urine must have some channel for escape, therefore in these cases urinary fistula will always be found. An *obliteration* of the urethra, the result of injury or traumatic stricture, is also met with.

Locality of Stricture.—For the only definite facts relating to this subject, I must refer—and I do so with pleasure—to the labors of Sir H. Thompson; for although other writers have given their "impressions" upon the subject, and have published isolated cases, it is to him that the profession is indebted for the analysis of 270 preparations contained in the various museums, by which alone this question could have been satisfactorily determined. He has most satisfactorily proved what is now generally received as true, that in by far the majority of cases of stricture the juncture of the spongy and membranous portions of the urethra is its most frequent seat (Fig. 254), and that the next position in point of frequency is the inch situated in front of this spot; exceptional cases being found in the prostatic end of the membranous portion. The centre of the spongy portion is the next position in order of frequency in which strictures are to be found; the external orifice and the terminal two inches of the urethra coming last: no specimen exists in which a stricture has been observed in the prostatic portion.

FIG. 254.



Looking over my own cases with the view of inquiring into the *causes of stricture*, I find, omitting congenital narrowing of the urethra and injuries, that out of the 646, chronic gonorrhœal inflammation had existed in 273 instances; and that direct injury was the assigned cause of 43; leaving 330 cases in which no definite cause could be obtained. Out of the 273 cases in which a gonorrhœa had previously existed, it is also to be observed that in 78 of these, injections had been employed in its cure. With these facts, it seems right to conclude "that although gonorrhœa often precedes a stricture, that at least half the cases are found in subjects who have not suffered from such a disease; and that when gonorrhœa might be put down as an assigned cause, the use of injections for its cure does not appear to have had any positively injurious influence in producing a stricture." I may add that the results thus brought out can be strictly relied on, as considerable care was taken when noting the cases to search out this fact; it may, therefore, unquestionably be asserted that injections have not the injurious influence in exciting stricture, which some authors have ascribed to them.

Amongst the 330 cases in which no positive cause could be assigned, were three in which "gout" existed; and several in which the contraction of chancres might fairly be put down as the cause of the obstruction.

I have been unable to make out that the so-called phosphatic diathesis has any influence in exciting the formation of an organic stricture, or any positive urethral disease, although this is a point upon which Sir B. Brodie has dwelt much; but there can be no doubt that any morbid condition of the urine has considerable power in exciting a spasmodic contraction of the muscular walls of the urethra, and more particularly when an organic stricture exists, and thus may be the cause of retention of urine.

Symptoms.—In a large proportion of the cases of simple organic stricture an attack of retention of urine is the first thing which attracts the attention of the patient. It may be that some indiscretion in diet, some excess in drinking, or exposure to cold, is the immediate cause of the retention, and it is then, perhaps, for the first time that the patient can bring to his recollection the fact that other less marked, but not less certain, symptoms, had existed for some time previously. It may be, probably, that some *chronic gleet* had been present for many months; that some urethral pain had attended the act of micturition, some difficulty and frequency in the act, some irritability of bladder; the stream of urine may have been somewhat narrowed, divided, twisted, or of a screw shape; the act of micturition may have been prolonged; but these symptoms had failed by themselves to make sufficient impression upon the mind of the sufferer to lead him to suspect the existence of a stricture.

It must not be thought, however, that the retention is usually caused by the gradual contraction of the stricture. In exceptional cases such a condition may exist, but in the majority it is tolerably certain that the retention is due to some spasmodic action of the urethral muscles at the seat of stricture, for in a diseased urethra very slight causes appear capable of exciting spasmodic action of the canal, and, consequently, retention; spasmodic and organic stricture being generally combined. The frequent connection between retention of urine and organic stricture is well shown in the following analysis. My notes of 483 cases of stricture inform me that in 129, or more than a *fourth*, the patient was admitted into Guy's with retention. When the stricture is not discovered under these circumstances, it will, if not detected early, soon give rise to other symptoms more characteristic. The stream of urine will gradually contract, so that at last it will cease to exist, the urine passing only in drops. The bladder will become

so irritable that the patient will have to rise frequently in the night to micturate, and the effort will be attended with pain; a small quantity only of urine will, probably, also be passed; symptoms affecting the rectum will soon appear, the straining during the act of micturition being associated with tenesmus; at times these symptoms are so severe as to necessitate the use of the stool instead of the chamber, whenever natural relief is sought. Prolapsus recti, or piles, also frequently complicate the case; incontinence of urine may also appear.

Under these circumstances it is clear that the bladder is never emptied; some small quantity of the urine is passed at each act of micturition, but not the whole; enough to relieve present symptoms for a time, but not for long. The urine, being retained, undergoes partial decomposition and acts as an irritant; it becomes cloudy and ammoniacal, depositing more or less mucus and phosphates. The urine, collecting in the bladder, gives rise to distension of the organ; this, pressing on the rectum, excites tenesmus and prolapsus, and, interfering with the return of the venous blood, to piles. As this distension increases, the bladder loses its power of contraction, and as a consequence the *overflow* of urine gives rise to *incontinence*, this incontinence being a direct result of chronic retention. A physical examination of the abdomen of a patient under these circumstances will reveal the distended viscus as a central globular swelling, giving a dull sound on percussion.

At the seat of stricture during these changes others no less important are going on; behind the stricture the urethra becomes dilated, this dilatation being mechanical and the direct result of the ineffectual efforts of the bladder to overcome the obstruction. As the pressure continues inflammation of the urethra and parts around appear, the tissues become indurated as well as expanded, and after a time, from the continued irritation, the parts ulcerate. A few drops of the contained urine percolate into the cellular tissue behind the stricture and set up suppuration, and in this way a perineal urinary abscess is formed. To the fingers it will appear as a deep-seated perineal swelling, sometimes very indolent and painless, at others acute and painful.

Should this abscess open itself naturally externally in the perinæum, or be opened by the surgeon, a *perineal urinary fistula* will ensue.

Should no such result take place and the abscess remain, should the urethral stricture be unrelieved and the bladder with the abdominal muscles still continue to act and ineffectually so to overcome the urethral obstruction, the urine becomes forced into the dilated urethra behind the stricture, into the perineal abscess communicating with the dilated urethra, and sooner or later—unless the stricture be relieved—the wall of the abscess will give way, either by ulceration or rupture, and the urine will become freely extravasated into the cellular tissue of the parts around.

Should this giving way of the parts appear during the efforts of the patient or spasmodic action of the bladder and abdominal muscles to overcome the stricture, a momentary relief from the previous agony may for a time lull the apprehensions of the patient, and the sensation that something has given way may mislead him into the idea that all is well, but the swelling of the perinæum, scrotum, penis, and suprapubic region, will at once reveal to the professional eye the true nature of the accident, and with the absence of any flow of urine through the natural channel the evidence will be complete that the urethra has given way behind the stricture, and *extravasation* of urine has taken place.

At any period of a stricture's progress the obstruction is to be detected by the passage of a catheter. This may be of any form, according to the

fancy of the operator; but the best is, without doubt, that made after the fashion of the French catheter, with a bulbous extremity and tapering end (Fig. 255), or metallic instrument made somewhat in the same way.

FIG. 255.



During the development of a stricture, and more particularly when it has become a real cause of obstruction, a patient's general condition is rarely good; what are generally known as dyspeptic symptoms commonly exist; the digestive organs fail to do their duty as they do in health; the patient, consequently, often loses flesh, looks careworn and ill. As the disease progresses, a constant feeling of chilliness is very common, and rigors are not unusual; these symptoms are at times intermittent, and are then often looked upon as being due to "ague." When a perineal abscess is forming, these rigors are commonly present.

When they are uncomplicated with such a local cause, and are very frequent, there is good reason to believe that they indicate some renal complication; for it cannot be too strongly impressed upon the surgeon's mind that no stricture can long exist without producing secondarily important changes in the bladder and kidneys.

Organic strictures are not, however, all of the same character.

The Simple Stricture is the most usual, and beyond the mechanical effects of its existence it has no special feature.

The Irritable Stricture is comparatively rare; it is characterized by excessive sensibility on being touched by a catheter, and a disposition to bleed; it is also prone to be associated with chilliness, and even rigors.

The Contractile Stricture may belong to either of the two former groups; its peculiarity consists in its tendency to *recontract after its dilatation*.

It is important to bear these three divisions of organic stricture constantly in mind, for the successful treatment of a case will often turn upon their recognition.

TREATMENT.—Before any surgeon can say with certainty that a stricture exists, a urethral examination is a necessity, and this is an operation in which as many difficulties are experienced by the inexperienced as in many far more complicated ones; indeed, without some skill and confidence the attempt to pass a full-sized catheter down a healthy urethra is constantly foiled.

To pass a catheter it is usually wise to place the patient on his back in the recumbent position, with the shoulders slightly raised and the knees separated. The surgeon should see that he is lying quite flat and straight, and the lower part of his abdomen should be uncovered to expose the navel, this point being the best guide to the line of the urethra. A large metallic instrument should usually be selected for the examination, No. 7 or 8 being the best; and this should be made moderately warm by being dipped in warm water, or rubbed by the hand and thoroughly well oiled. The surgeon should stand on the *left* side of the patient, and with his left hand raise the penis; he should then introduce the end of the catheter into the penis, keeping its point well to the *lower* surface of the urethra during the introduction of the first three or four inches, in this way avoiding the lacunæ of the urethra that exist in the roof of the passage. The handle of the instrument, at this step of the operation, may be directed over the left thigh of the patient, or, what is preferable, be maintained over the median line of

the body in the direction of the umbilicus. With the left hand the surgeon may then gently draw the penis up the instrument, which he with the right allows to slip down the passage by its own weight, simply directing it with a light hand, and the end having reached the bulbous portion of the urethra the handle of the catheter is to be gently raised and depressed in the central line of the body, when, if no obstruction exists, the bladder will be entered, the point of the instrument being kept well along the *upper* surface of the urethra. In a healthy urethra the surgeon has little more than to *guide* a metallic instrument into the bladder, the weight of the catheter alone being nearly sufficient to allow it to pass down the passage, if directed with skill. Half the errors in catheterism arise from a non-appreciation of this fact, the desire to *pass* the catheter originating efforts that interfere with the entry of the instrument into the bladder under proper guidance.

When a stricture exists the catheter will be arrested in its course; it should then be withdrawn an inch or so and passed on again, with the handle slightly altered in direction. If the obstruction still exists the instrument is to be withdrawn and a smaller size employed, and on this failing to glide by the obstruction a still smaller one, and so on till the stricture is entered.

In this way the seat of stricture or strictures and the nature of the contraction will be made out. If much pain attend the examination the surgeon has either employed too much force or an irritable stricture exists. When bleeding follows, this latter probability is strengthened, particularly if the surgeon is conscious that no violence has been employed. For catheterism ought never to be attended with violence. "Whatever the obstruction, it is never to be forced; temper, patience, and a light hand, will overcome almost all cases of difficulty. All attempts at rapidity of execution are wholly out of place, fraught only with danger to the patient, and calculated to reflect discredit on the operator" (Sir H. Thompson).

Some surgeons prefer the patient to occupy the erect position in passing a catheter; I cannot recommend it; there is more chance of inflicting injury by the patient moving than in the recumbent, and the surgeon has not so complete a control over his instrument or patient. In stricture it is certainly a wrong one. The mode known as the "*tour de maître*" is named only to be condemned; in the hands of a skilled surgeon it may be done with impunity, but in those of an inexperienced man it is fraught with danger. The plan consists in introducing the catheter with the handle presenting downwards and convexity of its curve upwards, passing it then along the urethra down to the bulb, and then onwards into the bladder by describing a half circle with the instrument, and, when the handle has reached the median line of the body above, gradually depressing it, the end of the instrument in this turn being made to enter the bladder.

A stricture having been made out to exist, how is it to be treated? It is to be treated on a principle, there is little doubt, and the principle should be based on its pathology.

Now, the pathology of stricture is simple; it has been already said to consist in the deposition of inflammatory products in the mucous and sub-mucous tissue, and their subsequent contraction.

The principle of treatment is also simple, for, in a primary point of view, it is to dilate the contracted canal, and, in a secondary, to obtain the absorption or breaking-up of the effused inflammatory products. The more simple the means by which these ends can be secured the better.

Where the first end has been obtained without the second, temporary benefit may have been effected, but no more. Where both ends can be gained by simple means, the treatment must be pronounced to be good.

In ordinary cases of organic stricture, there is little doubt that these ends are to be secured by means of *gradual dilatation* of the stricture; and that by means of such local treatment alone the majority of cases of organic stricture are to be successfully overcome.

This treatment is to be carried out in the following way. At least, the way I am about to describe is certainly the most rapid and effectual mode of treatment the surgeon has at his disposal; the only objection is that it necessitates about a fortnight's rest.

The size of the stricture having been gauged, an elastic conical catheter, with a bulbous end, is to be taken and well oiled, and as large a one as can be passed through the stricture introduced. Should the English catheter be preferred, it is to be made soft and flexible by being dipped in warm water, or by friction with the finger. The latter is to be used without the stilet. The penis of the recumbent patient is to be raised by the surgeon's left hand and drawn forwards and slightly downwards, so as to make the urethra as straight as possible; the catheter is to be then introduced, and passed gently down the passage; should obstruction be felt, it may be slightly withdrawn, and then pressed forwards, the largest instrument the stricture will admit without force being introduced. The instrument, having passed the stricture and entered the bladder, is to be fastened in. (Fig. 256.)

FIG. 256.



The orifice of the catheter may be plugged with a peg of wood, or, what is better, the end may be capped by a piece of india-rubber tubing, the free end being dropped into a urinal, or tied in a knot to prevent escape.

If after twenty-four hours, the catheter moves freely in the stricture, it may be removed, and the next size introduced, the surgeon being careful not to be tempted to introduce a size that fits the stricture too firmly. On the third and following days the same practice may be followed, and in about ten days a complete dilatation of the stricture will probably have been perfected. Should the catheter not move freely in the stricture, it is to be left a few hours longer. When the presence of the instrument in the bladder causes irritation, and this is not remedied by alkalies, such as the citrate or tartrate of potash, with buchu and hyoscyamus, it is a good plan to have the catheter removed some few hours before a larger size is introduced, in this way giving the bladder rest. When it is impossible to maintain rest, a catheter may be passed in the evening, retained all night, and removed in the morning. At other times, where the symptoms are more severe, some slight intermission of the treatment may be advisable, the passage of the catheter alone being practiced. After the stricture has been fully dilated, the daily passage of an instrument for a few days subsequently is all that is called for, the interval between the introduction of the catheter being gradually lengthened.

The patient need not be confined to bed always during this treatment; he may get up daily and lie on a sofa, or sit quietly in a reclining chair. Should movement, however, cause irritation of the bladder, it must be forbidden.

In severe and neglected strictures this plan is one that ought always to be followed when possible. It is sound in its principle, safe in its practice, and as expeditious as is consistent with the object aimed at.

In less severe cases, or where rest cannot be obtained, the introduction of an instrument on one day, and after the lapse of two days its reintroduction, followed by the employment of a larger size, and so on, till com-

plete dilatation of the stricture has been effected, is the second best plan. It is more tedious than the former, and in the end is successful, but patients so treated doubtless require the more frequent introduction of a catheter to maintain the urethra in its dilated condition than others treated by the former plan. For this method of treatment, metallic instruments are better than elastic.

When a stricture is so contracted that a catheter cannot be passed even after very careful manipulation, the attempt should be given up and alkalis given; when the urethra is irritable, opium, enforced rest, the hip bath, are of use. After the lapse of a day or so, success may follow. When the stricture is reached by the catheter, gentle pressure upon it may be employed; indeed, this may be kept up for two or three minutes, the parts often yielding under its influence, and allowing the instrument to pass. Should this end be obtained, let the surgeon rest satisfied and leave the catheter in—whether silver or elastic—for should he remove it he will in all probability fail to pass a second. Should the instrument be a silver one, an elastic one should be substituted when it is removed.

When a catheter is grasped and “held” in the urethra, the operator may be tolerably sure that he has entered the stricture; should the end be movable he may be equally sure that he is in a false passage. When the catheter has been held and has passed forwards into the bladder, all is well; when it slips suddenly into a movable space the urethra has probably been perforated.

Under these circumstances, when a false passage probably exists, it is wise to give up local treatment for a few days, and let the parts heal.

After the full dilatation of a stricture it is important to bear in mind the fact that contraction will again take place, after a time, if the passage be not kept open. The introduction of a catheter once in every two, three, four, or more, months, according to circumstances, is generally enough to prevent this result taking place.

What in modern language is called “*the immediate treatment of stricture*,” is in reality a rupture or splitting of a stricture, it being in all probability a rare thing for a stricture to be suddenly, fully, and rapidly dilated without laceration taking place. This plan has certainly a taking title, and in practice has apparent advantages, which, if supported by experience, will establish its claims upon the attention of surgeons.

In our day the plan is known as that of Holt, but Holt’s instruments are mere modifications of M. Perrève’s, made in 1847, and the practice is based upon that adopted by Mr. T. Wakley, Dr. Hutton, of Dublin, Maissonneuve, Buchanan, and others.

Holt describes his instrument to “consist of two grooved blades, fixed in a divided handle, and containing between them a wire welded to their points, and on this wire a tube (which when introduced between the blades corresponds to the natural calibre of the urethra) is quickly passed, and thus ruptures or splits the obstruction.”

The stricture having been split the dilator should be rotated to still further separate the sides of the rent, and then be withdrawn; a catheter corresponding to the number of the tube being substituted for the purpose of removing the urine. In his hands the practice has been most successful; he has split no less than 670 strictures with only two deaths. But in the hands of other surgeons similar success has not been recorded. This method, however, no more effects a permanent cure of stricture than the plan of dilatation already given; for every hospital surgeon has been called upon to treat cases of stricture that had been subjected to the plan and had relapsed. Indeed there is reason to believe that after Holt’s method an early relapse

is more common than after other methods. There is good reason also to believe that bad, and even fatal effects, are more common after the splitting operation than gradual dilatation.

The plan of treatment I have given of dilatation is absolutely safe. It is never followed by a fatal result. After the splitting of a stricture this cannot be said; the fatal cases are, it is true, far from common; but in what proportion to the successful, facts are wanted to establish.

To narrow, ring or annular, subpubic or penile strictures, Holt's method is probably well adapted; but for indurated, ribbon, or tunnel strictures, it is dangerous and ill adapted.

When a stricture is associated with a vesical calculus and it is a matter of necessity to cure the one before lithotomy is employed, the immediate method may be used; but it ought to be understood that a greater amount of danger attends its practice than follows the more ordinary method.

The best instrument for this plan of treatment is that made by Weiss for Mr. B. W. Richardson, of Dublin. (Fig. 257.)

FIG. 257.



Richardson's dilator.

But all strictures cannot be treated by dilatation. "Cases of stricture do occur occasionally which are so exquisitely sensitive that the passage of a catheter, however skilfully performed, is followed by such severe constitutional and local disturbance as to produce more harm than good, and in which it is clear some other method of cure must be employed; and others which are relieved by means of the catheter, and are even fully dilated, but which have a tendency to contract again immediately upon the omission of the treatment. In the former case the treatment aggravates instead of relieves the symptoms; in the latter it must be continued for life to preserve an open passage.

"Under such circumstances some other plan of treatment must be adopted;" and I believe now, as I believed then, when these words were written (1858), "the most beneficial to be the external division of the stricture from the perinæum; and it is to the late Professor Syme that we are here especially indebted for having so ably recalled our attention to the treatment of such troublesome and painful cases." ("Guy's Rep.," 1858.) I have followed this practice in a good many instances, and have never had any reason to regret the practice.

The surgeon must not, however, in all cases of irritable stricture run to the conclusion that Syme's operation is called for. It is only in exceptional examples of this form of stricture that it is needed. For in some the irritability rapidly disappears under the use of the catheter, and in others rest, alkalies, and opium have a most beneficial influence. Should these fail, the cutting operation may be performed, but not till then.

Recently the laminaria stalks have been employed for dilating stricture, but for perineal strictures they are dangerous, being apt to break. For strictures at the orifice of the urethra, from the contraction of cicatrices, they are most valuable, but for all other forms they are ill adapted. A laminaria tent swells to at least twice its diameter; it may be introduced into the urethra dry and left there, a small shield being fixed to one end to prevent its slipping into the passage.

Caustics are not, at the present day, much employed in the treatment of

stricture; few surgeons, indeed, use them at all. The practice in theory is not a sound one, and in its results is uncertain, and probably injurious, for it is impossible to apply such a caustic as the potassa fusa to the seat of stricture alone, and when tissues are destroyed by its influence they will subsequently cicatrize and contract, and thus add to the mischief. All that can be said in its favor will be found in Mr. Wade's work, but it is not a practice that can be recommended in any way.

Urethrotomy.—This is a comprehensive term, and includes the *internal* division of a stricture, and the *external* through the perinæum.

Internal urethrotomy, except for strictures at the orifice of the urethra and within the penis, is not an operation for which much can be said. In sub-public strictures it is dangerous, and no more effective than other plans of treatment. In penile stricture, more particularly of the urethral orifice, it is a safe and valuable practice. Many instruments have been invented for the purpose, and Stafford's instrument, made in 1827, is well known. Fergusson employs a long grooved director, which he passes through the stricture, and a very narrow-bladed knife, which can be buried in the groove; but the best instrument is the one that divides the stricture from behind forwards on its withdrawal, such as that known in France as Trélat's (Fig. 258). In strictures of the orifice a bistoury may be used.

After the division of the stricture a large catheter should be passed and left in, to keep the parts asunder and assist in the absorption of the organized lymph. In orificial strictures, after their division, the laminaria tent is the best to use, with a shield.

Maissonneuve employs a filiform gum-elastic bougie as a guide through the stricture, and a grooved steel director which is screwed on to the bougie and pushed into the bladder. He then divides the stricture by means of a triangular-shaped urethrotome passed along the groove, a large catheter being passed into the bladder when the stricture has been divided. But in this operation the stricture is permeable, and, consequently, urethrotomy is not called for.

Thompson thinks better of internal urethrotomy in hard, old strictures, than of rupture. Subcutaneous perineal urethrotomy is on its trial; it is an operation of some promise.

External Urethrotomy is a valuable operation in selected cases. It includes two very different measures; *one*, in which the stricture is divided through the perinæum upon a grooved director, passed through the stricture—*external division* or Syme's operation. *The other*, in which the perinæum is laid open *without* a urethral guide, the stricture being impervious. To this the term *perineal section* ought to be confined.

Syme's operation, as already stated, is valuable in the highly irritable as well as contractile stricture, in cases which Syme described as strictures that "continue to present symptoms after being dilated," and that "are indomitable by the ordinary means of treatment."

The operation is by no means one of difficulty. A grooved staff, as large as can be passed through the stricture, is first introduced, the patient having been placed upon his back, as if about to be cut for stone. The surgeon should then, with perfect precision, introduce his knife into the centre of the perinæum, and at one stroke cut

FIG. 258.



down upon the groove situated at the lower border of the staff; using this as his guide, the perineal portion of the urethra, in which the stricture is situated, can be readily and freely divided. There are but two important points to be observed in this the second step of the operation; the first is to be sure that the knife touches the groove of the staff; and, secondly, that the whole of the diseased or strictured portion of the urethra is freely divided.

Having succeeded in this, the essential part of the operation, the sound may be removed, a grooved probe or director having been previously introduced into the bladder through the perineal wound. Upon this an elastic catheter of a large size can be readily introduced through the penis into the bladder, and fixed in.

Syme employed a staff as a director, and in his later operations, instead of passing a catheter through the urethra, introduced one (Fig. 259), through the perineal wound for twenty-four hours.

FIG. 259.



Syme's perineal catheter.

The patient should then be sent to bed, and a mild opiate given, such as ten grains of Dover's powder, if much general or local vesical irritability exists. The catheter may be left in for several days if it should fail to cause pain, but if the bladder resents its presence it may be removed; indeed, I am somewhat disposed to think that the presence of a catheter is hardly needed. In many of my recent cases I have given it up, and have had no reason to regret the practice; but more experience is called for before the omission of its use can be recommended.

After the wound has closed the occasional introduction of a catheter is essential, for I cordially agree with Professor Syme in thinking "that prudence requires that every patient who has had a stricture divided should learn to introduce bougies, since by doing so, at intervals of a week or fortnight, he will be perfectly secure from future trouble."

The division of a stricture, no more than its dilatation or rupture, permanently cures it; occasional dilatation is essential to maintain its patency.

The operation is usually a successful one, and out of nineteen consecutive cases at Guy's one only died, and that from extensive kidney disease.

Perineal section is a more difficult and dangerous operation than Syme's. It is called for also in far more severe cases, when the urethra is impervious, and no guide to the urethra exists beyond that which the surgeon's knowledge of the anatomy of the parts affords; and it must be remembered, that as a rule, the normal anatomy has been nearly destroyed, for impervious strictures requiring urethrotomy are usually chronic, complicated with extravasation, suppuration, and urinary fistulæ.

The operation I shall describe is the one suggested and practiced by Mr. Cock, and no more competent authority in urethral disease exists. If a catheter can be passed into a bladder through a stricture, his hands can do it; and yet he never fails to admit that he has met with cases in which the urethra was impermeable, and for which perineal section was required.

Cock's operation is at once easier, simpler, and much more successful than the one usually described; for, as he writes, "the objects aimed at in the operation can be accomplished, while I doubt if those of the other have ever been fulfilled." "However complicated may be the derangement of the perinæum, and however extensive the obstruction of the urethra, one portion of the canal behind the stricture is always healthy and often dilated, and is accessible to the knife of the surgeon. I mean that portion of the urethra which emerges from the apex of the prostate, a part which is never the subject of stricture, and whose exact anatomical position may be brought under the recognition of the finger of the operator. Thus, when we cannot introduce a catheter by the ordinary method, and even when we cannot tap the bladder through the rectum, it still remains to us to tap the urethra as it emerges from the prostate, and thus to effect the desired communication."

The operation which Mr. Cock has described as "tapping the urethra at the apex of the prostate, unassisted by a guide staff," is performed in the following manner. I have seen Mr. Cock do it frequently, and have performed it on many occasions, and have no hesitation in giving it as the operation for external urethrotomy without a staff. I give it in Cock's words, taken from "Guy's Hospital Reports," 1866:

"The only instruments required are a *broad* double-edged knife with a very sharp point, a large silver probe-pointed director with a handle, and a canula or a female catheter, modified so that it can be retained in the bladder (Syme's perineal catheter is the best).

"The patient is to be placed in the usual position for lithotomy; and it is of the utmost importance that the body and pelvis should be straight, so that the median line may be accurately preserved. The left forefinger of the operator is then introduced into the rectum, the bearings of the prostate are carefully examined and ascertained, and the tip of the finger is lodged on the apex of the gland; the knife is then plunged steadily but boldly into the median line of the perinæum, and carried on in a direction towards the tip of the left forefinger, which lies in the rectum. At the same time, by an upward and downward movement, the vertical incision may be carried in the median line to any extent that is considered desirable. The lower extremity of the wound should come to within half an inch of the anus.

"The knife should never be withdrawn in its progress towards the apex of the prostate; but its onward course must be steadily maintained until its point can be felt in close proximity to the tip of the left forefinger. When the operator has fully assured himself as to the relative position of his finger, the apex of the prostate and the point of his knife, the latter is to be advanced with a motion somewhat obliquely either to the right or the left, and it can hardly fail to pierce the urethra. If in this step of the operation the anterior extremity of the prostate should be somewhat incised, it is a matter of no consequence.

"In this operation it is of the utmost importance that the knife be not removed from the wound, and that no deviation be made from its original direction until the object is accomplished. If the knife be prematurely removed, it will probably, when reinserted, make a fresh incision and complicate the desired result. It will be seen that the wound, when completed, represents a triangle; the base being the external vertical incision through the perinæum, while the apex, and consequently the point of the knife, impinges on the apex of the prostate. This shape of the wound facilitates the next step of the operation.

"The knife is now withdrawn, but the left forefinger is still retained in the rectum. The probe-pointed director is carried through the wound, and

guided by the left forefinger enters the urethra, and is passed into the bladder. The finger is now withdrawn from the rectum, the left hand grasps the director, and along the groove of this instrument the canula is slid until it enters the bladder.

"The operation is now complete, and it only remains to secure the canula in its place with four pieces of tape, which are fastened to a girth round the loins.

"A direct communication with the bladder has now been obtained, and the relief to the patient will be immediate; unless the kidneys have become irremediably disorganized, we may confidently anticipate a favorable result; and the restoration of the urinary organs will be more or less complete, in proportion as the obstructed portion of the urethra is more or less amenable to the ordinary judicious treatment of stricture.

"The canula may generally be retained in the bladder for a few days, and if the state of the urine renders abluition necessary the viscus may be frequently washed out. The canula may then be removed, cleansed, and reintroduced. A flexible catheter is sometimes more desirable and congenial to the feelings of the patient than a metallic canula.

"If the previous destruction has not been very great, and if the case progresses favorably, the swelling of the perinæum and scrotum gradually subsides, the induration disappears, and the urinary sinuses become obliterated. The urethra may then be examined in the ordinary way, to test its permeability, and one may be agreeably surprised to find that the sound or catheter readily passes through the former stricture until it strikes against the canula. An attempt may then be made to introduce a flexible catheter into the bladder, and its passage may, if necessary, be facilitated by passing a director through the perinæum into the bladder, and guiding the catheter along its groove. The urethra, once restored to its normal condition and calibre, the artificial opening through the perinæum soon heals up, and, barring the liability of stricture to return if not attended to, the cure may be said to be complete.

"We must not, however, always expect so favorable a result. I have operated in several cases where the obstruction of the canal was complete, and impermeability permanent.

"In such cases the patient is condemned to pass his water through the artificial opening in the perinæum, unless a new passage should be bored to unite the upper and lower portions of the patient's urethra—an operation which I have seldom or never known to be successful.

"The necessity of micturating through the perinæum may seem to be a considerable hardship, but with a little arrangement the inconvenience is not very great, and be it remembered that the man's micturition is merely assimilated to that of the other sex.

"To keep the artificial passage in a permeable state, it is generally necessary to pass a flexible bougie through the opening occasionally, and to retain it *in situ* for a few hours. The patient very soon learns to do this for himself.

"I have now under my frequent observation two men, on one of whom I operated twenty-five years ago, on the other twenty; and both are thankful for their condition.

"I have not found this operation, with its result, in a permanent factitious urethra, at all interferes with the sexual function, although it is, of course, a complete bar to procreation."

I have given this operation fully in the words of its originator; it is, doubtless, the only form of perineal section that ought to be performed in an impervious urethra, and is not sufficiently known. It is an admirable

operation. Having opened the urethra behind the stricture, the surgeon may examine the stricture itself, with the hope that a passage may be found through it, being guided to its distal end by means of a grooved staff introduced through the penis, down to the obstruction. The urethra, having been opened beyond the stricture upon the staff, may then be examined, and its two sides held well apart; for this purpose Avery used to pass a loop of silk through each edge of the divided urethra. Should the surgeon be fortunate enough to slip a fine grooved director through the stricture, as suggested by Arnott, its division will be readily accomplished.

Under these circumstances a catheter should be passed through the penis into the bladder, and that introduced through the perineum withdrawn. I need hardly say, however, that it is very rare for the surgeon to be able to trace the urethral passage through the stricture.

Complications of Stricture.—I have thus far dwelt upon organic stricture, *permeable* and *impermeable*, with its treatment, having made but passing reference to its complications; I propose now to consider these points more fully, including perineal abscess, extravasation of urine, and perineal fistula, all of which are the direct results of stricture, and of local or diffused urinary extravasation.

The pathological process by which an extravasation of urine is produced as a result of stricture has been already dwelt upon in a former page; it is a complication which will almost necessarily follow a neglected stricture, being one of the means which nature adopts to find an outlet for the urine when the natural passage has become so contracted as to forbid its flow; it is a complication of great danger to the patient, and requires in its treatment great decision on the part of the surgeon; the contact of urine with any tissue of the body, except those naturally in contact with it, being followed by its almost certain death. The early detection, therefore, of the beginning of an extravasation is an important point, and demands from us a few practical remarks.

If a patient, the subject of a stricture, appears before a surgeon suffering from febrile symptoms more or less severe, a parched skin, a dry tongue, and a rapid, irritable pulse, with or without an occasional rigor, whether there exist any local symptoms sufficient to have attracted the notice of the patient or not, the mind of the surgeon should always be directed to this point, and a careful examination made of the perineum and the parts around. The stream of urine will probably be somewhat small, but this the patient will confess to have been the case for a long time. On examining the perineum the surgeon will probably discover in the region of the bulb a circumscribed and almost solid mass; on firm pressure some pain may be produced, but the patient will frequently add that this swelling has existed for some weeks, and that it cannot be that which is the cause of all his symptoms.

The surgeon, however, must not be misled. This circumscribed mass is in effect a urinary abscess, the result of a local and limited extravasation, and the symptoms will only disappear when its contents have been evacuated.

What treatment, then, should be pursued? If the urethra be examined, the stricture will almost to a certainty be found much contracted, and the stream of urine will also be very small. Some discharge from the urethra may perhaps be observed, a little of the pus contained within the abscess behind the stricture at times making its way by the natural passage; and an instrument will be passed with considerable difficulty into the bladder. If it be made to pass the stricture it may then only enter the dilated, ulcerated, and suppurating cavity of the abscess situated behind, and it will be a matter of difficulty to find the urethral opening situated at the vesical

orifice of the abscess, and, as a consequence, it will be exceptional to be able to force the instrument onwards into the bladder.

What, then, is to be done? The abscess must be opened and its contents evacuated; for, if not, it will to a certainty increase, and being bound down by the perineal fascia it will pass backwards, and thus spread mischief around the neck of the bladder, and in the cellular tissue of the pelvis, to the serious injury of the sufferer.

The treatment of the stricture is a point also to be remembered, as this was the primary cause of the suppuration, and no treatment can be regarded as scientific if it be not directed to remedy the stricture, as well as the local urinary abscess which was its result.

Some surgeons, I am well aware, are satisfied to open the abscess in the perineum, and to leave the stricture alone, to be subsequently treated by dilatation or by other means; but it appears to be the soundest and most correct practice to open the abscess, and at the same time to divide the stricture. This is readily done by passing a grooved staff through the urethra into the abscess, and freely dividing all the tissues by a scalpel introduced through the perineum; in fact, by performing Syme's operation. If the orifice to the vesical end of the urethra can be detected with a probe, a large catheter should be passed and left in; but this point is not of essential importance, as by the operation the surgeon is certain that the stricture has been divided, all pus is freely evacuated, the possibility of further extravasation taking place is prevented, and a free outlet for the urine has at the same time been obtained.

By adopting this practice much time is saved, the stricture being treated, and probably cured, by the same means that are absolutely essential for the treatment of the complication.

Perineal abscesses, however, not infrequently occur unconnected with stricture; these should be opened early to prevent their breaking into the urethra and degenerating into urinary fistulæ. Syme's operation under these circumstances is not required.

The complication of extravasation of urine does not, however, always appear in the form we have just been describing; the urinary abscess, the result of a local and confined extravasation, is the simplest form in which this urinary extravasation comes before our notice, and the treatment by which it is to be met is as definite as the local symptoms are marked, when the attention of the surgeon has been directed to the part. But the cases of extravasation to which I must now draw attention are of a severer nature; are more sudden and marked in their symptoms; and are more fatal in their effects; requiring also at the hands of the surgeon an active and energetic practice. They are the result of a sudden rupture of the urethra, or of the walls of an abscess communicating with it; the rupture taking place suddenly during some effort of a patient, the subject of a narrow and contracted stricture, to relieve his distended and overcharged bladder.

The symptoms by which the complication is manifested are very marked. The patient will probably tell you that during some sudden expulsive effort to pass his urine, he felt something give way, this sensation being probably attended with some immediate relief to the symptoms of retention of urine, by which he had been previously tortured; other symptoms, however, will rapidly make their appearance. The patient will soon discover that the relief which he experienced was not the result of a flow of urine from the natural passage; and he will soon find, from the rapid enlargement of the perineum, scrotum, and penis, that something wrong has taken place. A burning pain will probably be experienced in the parts thus gradually enlarging, increased at each expulsive effort made to relieve the distended

bladder, the absence of which, on the first onset of the extravasation, having deluded the patient into a false idea of relief and safety.

The surgeon, if now called to see this patient, will probably find him laboring under retention of urine; the perinæum, penis, and scrotum, will be more or less swollen and oedematous from urinary infiltration; the extravasation, perhaps, having made or making its way upwards over the abdominal parietes, even to the thorax; if the symptoms have existed long, a peculiar inflammation and gangrene of the integuments will have made its appearance, and all the constitutional symptoms described as typhoid will certainly be present.

What, under these circumstances, is to be done?

If a catheter can be manipulated into the bladder, and the urine drawn off, a great point will have been gained, taking care to leave and fasten in the instrument.

If catheterism be impossible, as will too often be the case, some other steps must be taken to relieve the retention as well as to treat the complication of extravasation; and it becomes a question in the surgeon's mind as to which operation he shall select: should he puncture the bladder per rectum, and thus relieve the more immediate symptoms, and then proceed to treat the extravasation; or should he, by one operation, treat both? The latter plan appears to me to be by far the most scientific and correct practice, and is not one of greater difficulty.

The extravasation of urine has only to be treated in one way, that is by free incisions; in another page it has been explained how destructive the urine is to all tissues with which it comes in contact, and when extravasated there is a certain death to all the parts into which it is infiltrated unless a free escape be given to it by liberal incisions. The surgeon, then, in his treatment, has three objects to keep in mind: the *first* is to secure a free and ready outlet for the urine from the bladder, and thus to relieve the retention and prevent an extension of mischief; the *second* is to relieve the tissues, already infiltrated, of their extravasated urine, and thus to prevent their total destruction; and the *third*, which is no less important, is to cure the stricture, and thus to remove the cause upon which the complication originally depended.

The second object is readily secured by free incisions made through the integument into the infiltrated cellular tissue. The first may perhaps, as already stated, be fortunately secured by the passage of a catheter, and if this fails the end might be obtained by puncturing the bladder through the rectum; but this latter practice does not appear to be scientific, as it evidently is only a partial remedy—it relieves immediate symptoms, but nothing more; leaving the stricture, the “*fons et origo mali*,” unnoticed and untreated. Any treatment, therefore, which will relieve the retention, give free vent to the infiltrated urine and treat the stricture, that is, which can of itself fulfil the three required conditions to which attention has been drawn, must be at once admitted to be the soundest and most correct. Either the external division of the stricture, or the perineal section, is evidently then the right operation to be employed. By either the obstruction to the flow of urine is removed and the stricture divided; an outlet is also obtained for the urine which has been infiltrated, and a free vent is given for subsequent micturition; at the same time the other parts into which the extravasation has taken place must be freely incised. But the perineal incision is unquestionably the most important and essential step. Make free incisions, therefore, into the parts infiltrated with urine, and make the perineal incision extensive and deep enough to lay bare and to open freely the urethra, doing this, if possible, upon a grooved staff, forced

through the stricture, and if this end cannot be attained, by the operation which has been already described in another page; but a small grooved staff may be employed in by far the majority of cases, the employment of some force being perfectly justifiable to make it pass through the strictured portion.

Urinary Fistulæ.—These may be the result of a urinary abscess bursting in the perinæum or scrotum, or the consequence of a more diffused urinary extravasation, the fistulæ, under these circumstances, appearing in the perinæum, scrotum, groin, thighs, pubes, or nates. They are generally the direct consequence of some urethral obstruction. Occasionally, they follow a wound in the perinæum or urethra, accidentally produced, or some operation, such as lithotomy.

When the fistulæ are simple tracks communicating with a strictured urethra behind the obstruction, and the tissues through which they pass are healthy, they need not be regarded with any anxiety, for, in all probability, they will rapidly heal on the dilatation of the stricture, when the urine flows readily the natural way.

When, however, the fistulæ pass through indurated and diseased tissues, when they are associated with a contracted, if not impermeable, urethra, and are the result of some urinary extravasation and sloughing of the parts, the same success is not always met with. It is true that, when the stricture is dilated and cured, in a large number of cases the fistula will close, but this result will not take place in all. In exceptional cases the fistulæ refuse to heal, and they require the local stimulation of some escharotic, such as the nitrate of silver, liquor ammoniæ, tincture of cantharides, or the galvanic or actual cautery, to stimulate the indolent passage and assist its contraction. It is to be remembered, however, that in all these cases it is the entrance of the urine into the fistulæ that prevents their contraction and closure, and that any means by which such an occurrence can be prevented will be followed by recovery. To pass a catheter into the urethra and leave it in will not answer, for daily experience proves that the presence of the catheter excites urethral contraction, and urine soon flows by the side of the catheter, and enters the fistula. To allow the patient to pass his urine is equally injurious.

The only efficient plan is to have a catheter passed whenever the bladder requires to be emptied, and when this can be done by the patient himself the best success is met with. The surgeon, in such a case, should dilate the stricture to its full size, and instruct the patient to pass an elastic catheter into the bladder whenever natural relief is required, and where this practice is adopted there are very few instances of urinary fistula that require further treatment.

When difficulty is experienced in dilating the stricture, Syme's operation may be performed, the surgeon, when he can, laying open the fistula at the same time.

The urinary fistula following lithotomy is best dealt with by the galvanic cautery and catheterism. In these cases, however, the surgeon should always investigate the case sufficiently to assure himself that no second stone exists, or foreign body within the wound, for I have known a sponge, that had been applied to the wound to arrest bleeding, left in the parts, and prevent repair taking place, and a second calculus to be overlooked, and prevent recovery, the fistula healing when the stone had naturally been expelled through the fistulous perineal opening.

Urinary fistula communicating with the rectum, the result of some abscess, will generally heal as soon as the urine is diverted from entering the passage. The use of the catheter will sometimes do this; at others, posi-

tion will suffice, Sir H. Thompson giving a case in which recovery followed the practice of micturating in the prone position for one month. But any means that for a time will prevent the passage of urine into the fistula will probably suffice to allow of its contraction. When this does not succeed, the passage may be stimulated by the galvanic or other cautery. In exceptional cases a plastic operation may be called for.

The urinary fistulæ associated with loss of tissue, whether in the penis, scrotum, or perinæum, call for the greatest amount of ingenuity in the surgeon, for, besides the restriction of the normal channel, some plastic operation is often called for.

On Cicatricial or Traumatic Stricture.—The difference in the cause, the difficulties in the treatment, and the permanency in the nature of a so-called traumatic stricture, have led me to separate the cases thus denominated from that larger class which we have been just considering—the result of a local inflammation.

I possess the notes of forty-three examples of organic stricture, which may, without doubt, be fairly ascribed to the effects of a local injury. In all of them a distinct history can be obtained of some definite accident affecting the perinæum, the blow or fall being immediately followed by hemorrhage from the urethra, with or without other symptoms, and at a later date by difficulty in micturition.

These accidents as a rule, take place in boyhood or in young adult life, but no age is free from the dangers of such an injury. The kick of a man or horse on the perinæum, a fall upon a pointed instrument, or across a bar, beam, or rail; an injury from a saddle when riding, the blow of a rope, and sloughing of the perinæum after a violent contusion, are the principal causes to which the stricture has been assigned in the cases before me. In one and all there was clear evidence, at the time of the injury, that the urethra was more or less involved, as hæmaturia in almost every case immediately followed, and difficulty in micturition appeared at variable intervals after the receipt of the primary injury. In some few cases several years had passed away before the attention of the patient was called to the smallness of his stream of urine, and then, in a large proportion of the cases, some sudden attack of retention was the first symptom which attracted notice; but in the majority of cases the difficulty in micturition appeared rapidly after the receipt of the primary injury, and went on slowly but surely to increase.

The pathology of these cases is not difficult to understand; the urethra, by the injury, is either partially or wholly ruptured; the wound being transverse, union subsequently takes place, and the contraction of this cicatricial tissue in subsequent years produces stricture. It is this pathological fact which enables us to explain the obstinacy of the symptoms and the difficulty in the treatment.

Complications.—As in other cases of organic stricture, these traumatic examples are equally liable to be followed by like complications. The complications are the result of the obstruction to the urethra, and it is of little consequence in what way that obstruction may have been primarily caused. Amongst my forty-three examples of traumatic stricture, are twenty-seven cases admitted simply on account of their contracted stream and difficulty in micturition; in eight cases retention of urine was the immediate cause; in three, extravasation of urine, and in five, urinary fistula complicated the cases.

TREATMENT.—There are no cases of organic stricture, complicated or non-complicated, which are more obstinate in their treatment than the so-called traumatic. The nature of the obstruction being cicatricial, is quite enough to account for this fact, as it is well known that all cicatrices have

a constant and almost perpetual tendency to contract. A traumatic stricture—the result of a contracting cicatrix—is in its nature essentially a contractile stricture, and in its treatment it is very troublesome; if treated by dilatation it will recontract, and even if treated by perineal section or external division, it is far more likely to return than any form of inflammatory stricture.

All forms of treatment are consequently uncertain and unsatisfactory. If dilatation of the urethra is once secured, a constant introduction of the catheter is most essential, or otherwise the canal is certain to recontract; and if it is doubtful whether any case of simple inflammatory stricture is ever really cured, it may unquestionably be asserted that a traumatic stricture will exist for life, requiring constant and repeated treatment to preserve even a moderate patency of the narrowed passage. The principles of treatment in both varieties, however, are the same, although the practice may not be so successful.

If the urethra be permeable, the treatment by dilatation should be primarily employed, and this must be persevered in for some time if success is to be secured. If the stricture is so narrow and indurated as to refuse dilatation, and a grooved staff can be passed through, the operation of external division is the soundest practice, and gives the surest hopes of immediate and future benefit.

If the stricture be impermeable, and from its narrowness requires immediate treatment; or should its complications, either of extravasation or urinary fistula, demand attention, the perineal section must be carried out, the same method of its performance being applicable in these as in the cases previously referred to.

If extravasation of urine be present as a secondary result of this traumatic stricture, the same principles and practice which have been advocated in the treatment of simple organic stricture are equally applicable; as are also the recommendations which have been made for the treatment of perineal fistula.

The permanent success, however, of the practice in these traumatic cases, is not nearly so great as it is in the inflammatory, although the practice in both is really the same. It is hardly necessary to illustrate these facts, the experience of all surgeons will bear them out.

To show the greater severity of these cases, and the difficulties of their treatment by dilatation, it may be stated that out of the forty-three examples of traumatic stricture which have been tabulated, in six the operation of perineal section or of external division was absolutely required, or 14 per cent. of the whole number; whereas, amongst the cases of simple organic stricture, but 6 per cent. required operative interference, the simple treatment by dilatation answering every other purpose.

The Causes of Death from Stricture.—There are few local diseases which, if neglected, have a more fatal tendency than urethral stricture; and there are certainly none in which the progress towards evil can be so accurately and clearly traced. The portion of the urethra situated behind the stricture is the part which primarily experiences the evil influence of the obstruction; the bladder becomes subsequently involved, and last, but not least, the ureters and kidneys. The importance of the kidneys in the animal economy as excretory organs becomes, consequently, most apparent, and the fatal effect of disease in their structure is too clearly demonstrated.

To assert that renal disease is the sole cause of death from stricture would not, perhaps, be strictly true; nevertheless, it is the principal cause, and if these glands are not involved, stricture, and its complications, are not fatal.

Simple uncomplicated stricture is not a fatal disease, few cases terminating in death.

Stricture and retention of urine is a far more serious combination, and stricture with extravasation of urine is still more fatal.

It would thus appear that it is only when stricture has existed for a lengthened period, and has become complicated, that its fatal influence becomes apparent; the increase in the mortality of the cases increasing with the severity of the complication.

The duration of the stricture has necessarily a serious influence in producing a fatal result; the longer the obstruction exists the greater the probability, if not certainty, of the production of renal affection.

In 26 fatal cases before me, the average duration of the stricture was seventeen years; 5 cases only having shown symptoms under ten years; and 10 had complained of the disease for upwards of twenty years.

Under like circumstances it may be inferred with certainty that some disease of the kidneys has been produced, and that the slightest injury or accession of mischief is likely to terminate in death; for I imagine that every person the subject of renal disease stands, as it were, continually on the edge of a precipice, and that the slightest adverse wind may send him down. Thus is explained the death of so many cases after operations, whether upon the urinary organs or other parts; no patient with renal disease is able to resist the slightest tax upon his powers, vital energy sinking irrecoverably upon the receipt of the most trifling injury.

On Ruptured Urethra.—The secondary effects of an injury to, or a rupture of the urethra, have already met with consideration under the heading of traumatic stricture; and it has been shown that in at least 6.65 per cent. of the cases of organic stricture an injury was the assigned cause; it has also been shown that the worst and most intractable cases of stricture are those so brought about, and that the majority of examples of obliterated urethra are the product of the same cause. I propose now to consider the subject of ruptured or injured urethra together with its immediate effects and treatment, basing my remarks on the records of nineteen consecutive examples of this form of injury.

In the majority of instances the injury was caused by some direct violence applied to the perineum, such as a fall astride a post, plank, fence, or chair; a blow or kick is another cause which must be mentioned; and in not a few instances the injury has been produced by the passage of a cartwheel across the pelvis. It is somewhat difficult to understand how such a result can be produced by such a cause, unless some fracture of the pubic portion of the pelvis coexists; but explain it how we may, in practice we meet with cases of ruptured urethra following upon the passage of a wheel across the pelvis, and unconnected with any other symptom of its fracture.

The characteristic symptom of a rupture or laceration of the urethra is the passage of blood, which appears usually as an immediate result of the injury, and may be little in quantity or profuse; seldom, however, does this endanger life, and, as a rule, it subsides without treatment. If the injury has not been severe, it is just possible that this symptom is the only one by which the laceration can be recognized; and if some time is allowed to elapse between its receipt and the calls of nature to relieve the bladder, micturition may be completed with little or no difficulty, and convalescence may be re-established.

It is not often, however, that the subject of a lacerated or ruptured urethra escapes so easily, for in the majority of cases, retention or extrava-

sation of urine is the result, and it is for the relief of one of these complications that the advice of the surgeon is generally sought.

If called, therefore, to a patient who has evidently been the subject of an injury to the urethra, suffering from simple retention, the first object of the surgeon should be to attempt the passage of a catheter; if the urethra is not completely torn away, and there is not much blood locally effused, there will be a strong probability that he will succeed, and having done so, the instrument should be fastened in, the urine being allowed to flow through it as it is secreted, conducted at once by means of a tube into a vessel placed close at hand. If plugged, urine is sure to find its way into the perinæum by the side of the catheter; a gum elastic instrument, therefore, with a strong stilet, should be employed. If the attempt at catheterism, although having been fairly made, should fail, some other means must be employed, for it is clear that an outlet for the urine must be obtained, or otherwise, extravasation, with all its danger, will necessarily follow.

An incision into the perinæum on a grooved staff is unquestionably the soundest practice to adopt; by it the extravasated blood, and urine if present, find a ready outlet, and the bladder when it contracts will find a vent for its contents, without any danger of the extravasation of urine.

When the two ends of the divided urethra can be made out they may be brought together by a suture. Mr. Birkett did this with marked success in one case.

If the orifice of the vesical end of the ruptured urethra can be found with a grooved probe, a catheter should be passed, the instrument having been first introduced through the penis, and subsequently guided upon the grooved probe into the bladder; if difficulty is experienced in finding the orifice, there need be no alarm, as it is quite clear that the urine will readily find its way externally through the artificial wound; an early attempt to pass a catheter should, nevertheless, certainly be made, for it is most important that the continuity of the urethra should be restored as early as possible.

When a catheter has been introduced, it must be left in; for it is important that the patency of the canal should be maintained *during* the whole period of its repair, and its subsequent contraction in a measure neutralized. The frequent passage of an instrument *after* the repair has taken place, is an important point to be observed, this practice being the best guarantee that a cicatricial stricture will not be the result.

I have recently seen a man I treated, by a perineal incision, fifteen years ago for retention, following a ruptured urethra, and he has never had any difficulty in micturition since.

By way of summary of the treatment of stricture the following conclusions may be drawn:

1. At least ninety-five out of every hundred cases of stricture are readily and safely dilated by means of catheters, and every stricture might be so treated if recognized before any complications appeared.

2. Of *permeable strictures* it is only in the obstinately irritable and contractile forms that any other treatment is called for; and in these, external division, the plan recommended by Syme, is the best operation.

3. *Rapid dilatation or splitting* of the stricture may be a justifiable operation in these cases under exceptional conditions, although its practice is more adapted for ring penile than perineal strictures.

4. Strictures complicated with *urinary abscess* or *extravasation*, in which perineal incisions are called for, had better be treated by external division or Syme's operation, when a staff can be passed through the stricture; by perineal section, or Cock's operation, when no such guide can be employed.

5. In strictures complicated with *urinary fistulæ*, the stricture is the main thing to treat, its full dilatation being usually followed by the contraction of the fistulæ. When this result does not take place, it is essential that all urine be prevented passing into the fistulæ, and the best means to insure this is by the passage of the catheter whenever relief is required.

6. The *external division* of a stricture is a good operation in obstinate cases of permeable, contractile, and irritable strictures; in all cases of extravasation of urine in which perineal incisions are called for, also in long-indurated strictures complicated with urinary fistulæ.

7. *Perineal section*, or Cock's operation, is good in all cases of impermeable stricture or obliterated urethra, complicated or not with urinary abscess or fistula, in which a free outlet for the escape of urine is essential.

8. Internal urethrotomy, except in penile strictures, is not often called for, and the treatment by caustics is a dangerous one.

9. Cicatricial strictures are to be treated like others; but they are far more obstinate, and more frequently require external urethrotomy.

CHAPTER LV.

RETENTION OF URINE.

WHEN a patient is unable to pass his urine, he is said to be the subject of retention; and this retention may be due to the presence of organic or cicatricial stricture, spasm of the urethra, urethral obstruction from inflammation of the urethra or prostate, urethral calculus, and many other causes. I have already stated that it existed in 129 out of 608 cases of organic stricture admitted into Guy's during seven years; and in 5 out of 43 cases of traumatic stricture. It was also present in 80 other cases, the result of varied causes unassociated with stricture.

Retention in a child is generally from stone impacted in the urethra; in an adult, from stricture; in an old man, from prostatic disease.

Spasmodic stricture was the assigned cause in half—that is, it was found in subjects in whom no permanent narrowing of the canal existed; in almost all, excess of drinking, with or without exposure to wet and cold, were the exciting causes, and no complication aggravated the cases. One was in a boy, æt. 10, who paid the penalty of a drinking bout by suffering the pain of a retention. Catheterism relieved him. In all these 40 cases spasm of the muscles of the urethra was the assigned cause.

Spasmodic Stricture.—The fact that *true spasmodic stricture* exists is no longer a subject of doubt; that the seat of the stricture is also the membranous portion of the urethra which is encircled by muscles is also now generally acknowledged; and that the usual exciting causes of such a stricture are exposure to wet or cold, and excess in drinking, are clinical truths which the notes of the forty cases before me clearly prove. Anything, however, which can induce an altered or acid state of the urine is likely to be followed by this complication, gouty and rheumatic patients being particularly prone to such attacks. The *treatment* of these cases is not difficult; the simple passage of a large metallic catheter is the most expeditious and certain practice. The instrument should be well warmed and freely oiled; it is to be passed slowly, so as not to excite alarm or increase the spasm of the muscles; and in skilful hands its introduction is not an opera-

tion of difficulty. If, however, the operator should be foiled in his endeavors, he must be cautious not to employ force, which is never required, and never justifiable. *Chloroform* should then be administered, and with a patient fully under its influence all obstruction ceases, and the instrument will pass into the bladder. If there is an objection to the use of the anæsthetic, the old remedy of a *hot bath* is one which cannot be too highly extolled; few patients suffering from simple retention fail to micturate when thus immersed, and the introduction of a catheter is much facilitated. A *full opiate* is also an invaluable remedy, relieving the involuntary contraction of the bladder, which is so painful in cases of retention, and thus removing one of the most constant causes of spasmodic stricture. The value of opium in these cases cannot with some surgeons be upheld too strongly, leading them to assert that there is no case of retention of urine which will not yield to its benign influence, allowing either a natural relief or the introduction of a catheter. I am not disposed to go quite so far in this opinion, although the evidence of experience is generally in its favor, and in cases of retention it acts sometimes as a charm. The inhalation of chloroform, however, is a preferable remedy, its action being more rapid and more certain. Should failure follow the application of these means, other measures must be adopted; and without doubt the simplest, safest, and most expeditious practice is puncturing the bladder through the rectum, but in a simple spasmodic stricture such a necessity ought never to arise; when difficulty is felt, organic stricture complicates the case.

Inflammatory Stricture.—It has been already shown that in spasmodic stricture, exposure to wet or cold, and an altered condition of the urine, produced either from excess of drinking, gout, or rheumatism, are the chief exciting causes of an attack of retention; and if this be the case, there can be no difficulty in understanding that an equal result may be brought about, and is more liable to be experienced if the urethra itself should be the seat of an inflammatory action. Retention of urine at times comes before our notice as a result and concomitant of gonorrhœa. The causes of the retention are evidently compound, spasmodic stricture added to the mechanical obstruction produced by the œdema of an acute inflammation combining to produce the result.

The *treatment* which is therefore required to afford relief, must be based upon the appreciation of these two conditions which have combined to cause the effect. The retention is in a measure mechanical, and must be met by mechanical treatment; it is also functional, and as a consequence must be so considered.

The symptoms are urgent, therefore time is a great object; and if called to a case there are few surgeons who would not at once attempt to pass a catheter; let the surgeon choose an instrument of medium size, No. 4 or 5 being the best; let it be well warmed and well oiled, and then with gentleness and yet firmness the obstruction may be overcome; *arte non vi* must be the guide to action, as force is to be condemned in these cases as much as it was in the preceding.

If these means fail, a hot bath, and a full opiate, are the soundest remedies. They relieve the local turgescence of the passage, and therefore the obstruction, and with it the associated spasm. The use of chloroform in these cases cannot be recommended, as it merely relieves the spasm but does not alter the condition upon which the spasm depends, viz., the inflammation. If these means fail, which is not common, some operative measure may be required, which will be dwelt upon in another chapter.

Retention of Urine following a Blow in the Perinæum.—Under this head-

ing it is not my intention to allude to the cases of ruptured urethra. This condition has already been considered.

But as a result of simple contusion in the perinæum, cases of retention may appear before us. I possess the records of three such examples—two in children aged three and seven, respectively, and one in an adult aged twenty-nine; in all a simple contusion in the perinæum was the assigned cause. No hemorrhage or other symptoms of a ruptured urethra could be made out, and yet in all probability retention followed as the result of the contusion, and was caused by some spasmodic condition of the passage, excited by the injury. In all the cases, the simple passage of a catheter was the only treatment, and with the relief of the symptoms convalescence followed.

Retention of urine from the pressure of an abscess in the perinæum must be mentioned, as cases of retention from such a cause occasionally come under the surgeon's notice; abscess about the rectum is not unfrequently associated with such a difficulty. It must be treated by opening the abscess.

Paralysis of the bladder from any cause, situated either in the organ itself, or associated with spinal disease, is a common cause of retention, and the same complication may be found with fever or any other constitutional condition in which the vital powers of the patient have been much reduced, and the nervous system has, as a consequence, become unable to answer to its accustomed stimulus; as an associate, or rather symptom of peritonitis—local or general, from traumatic stricture, or, as a result of some other abdominal disease, retention of urine has passed under our notice. It is enough, however, for the surgeon to remember that this complication may be produced by the causes enumerated, to prevent any error being perpetrated. The cautious introduction of a catheter is the correct practice in such cases.

It is not, however, to treat retention of urine that the surgeon is usually called to such cases. An incontinence of urine is generally the form of malady which attracts notice, and it is from this that the surgeon rightly infers that a case of severe retention of urine is before him, the incontinence being merely the overflow of an already overdistended and engorged bladder.

The symptom of incontinence is a very positive one, and should never mislead any practitioner. It is almost always a concomitant and result of retention, and should be so regarded—at any rate until the surgeon has convinced himself, by a careful examination, that the bladder is not distended.

Retention of Urine as a Symptom of Enlarged Prostate, and in the Old.—It has been a common opinion, held by all surgeons for many generations, that an enlarged prostate is a very general condition of old age, and that retention of urine as a consequence and as a symptom of this affection is of frequent occurrence. The investigations of recent pathologists, and more especially of Sir Henry Thompson, have been to show that such an opinion is by no means true; that an enlargement of the prostate, either as an hypertrophy or from the development of independent prostatic glandular tumors, may take place, and, that when it does, it is most commonly met with in old people, but such a condition is by no means to be considered as a senile change.

When retention of urine takes place in old people in whom no stricture exists, it is too frequently ascribed to this chronic enlargement of the prostate, and as it is really a rare thing to find such a condition in the bodies of those that die, it is fair to believe that this retention is due to other causes, such as atony of the bladder, which may be relieved by the intro-

duction of a large catheter. This operation should always be undertaken with great care, as an injury to the prostate or bladder in old people is of considerable consequence. An elastic instrument with a full curve, in the hands of those who are not in the constant habit of using instruments, is to be preferred, and this may be passed slowly down to the neck of the bladder. It is at this point that the difficulty in its introduction is always experienced; but if the index-finger of the surgeon's left hand be introduced into the rectum, and the end of the instrument tilted upwards, by the slightest pressure with the right hand the catheter will, as a rule, be readily passed onwards, and relief secured.

Retention of urine may also be produced by an abscess situated in the prostate gland, and the retention is only relieved when the abscess has been opened. This treatment is, therefore, the one which should be followed.

Retention of Urine as a Result of an Elongated and Adherent Prepuce.—It is a somewhat inexplicable fact that surgical writers have, with rare exceptions, omitted to notice that an elongated prepuce and adherent glans penis to its mucous membranous covering is capable of producing retention of urine, with every symptom of vesical irritation; yet few surgeons can have had any experience at any hospital or dispensary without seeing many such examples, all of which are immediately cured by the removal of the cause. Cases illustrating this fact are not admitted into our metropolitan hospitals; but from my note-book I could bring forward numerous cases illustrating these points. I could quote cases in which an adherent prepuce had been the cause of retention of urine, and of incontinence of urine, in which it had produced symptoms of irritable bladder, and every other symptom of vesical calculus, even hæmaturia. Prolapsus recti is by no means an uncommon result of such an affection, and in one case, of a child three years' old, constant priapism existed. A prepuce adherent to the glans penis was the sole cause of all these symptoms, as proved by the fact that they immediately disappeared when the cause had been removed.

These cases all take place, or nearly all, in early life, and I never see a case of vesical irritation in children without first examining the condition of the penis. For some years I have been in the habit of pointing this fact out to students, and have always directed them, when examining a child suffering from any supposed urinary disorder, to take into consideration the condition of the penis before passing onwards to examine other parts, with the probability that, in at least two-thirds of the cases which pass under observation suffering from urinary irritation, an adherent and elongated prepuce is the sole cause. Circumcision, and the careful separation of the prepuce from the glans penis, with the removal of the confined secretion of Tyson's glands, is the only remedy; it is a simple one, and is most complete.

Retention of urine as a symptom of ruptured urethra has received attention in another page.

On Retention of Urine from Organic Stricture.—Amongst the many contingencies to which a patient suffering from permanent stricture is continually exposed, none cause more agony and alarm to the sufferer, or demand more prompt and decisive action on the part of the surgeon, than retention of urine.

This retention may be the result of a slowly contracting organic stricture; but it will probably be produced by some sudden accession of spasm of the muscles of the passage, and thus be compound in its nature, a spasmodic stricture being grafted upon an organic. The symptoms, however, are necessarily urgent, and it becomes an important question as to what practice is to be pursued. With this object it will be of interest to inquire, first of all, what practice has been proved of value? and, as a means to the

solution of the difficulty, I can show that out of 129 examples of retention from simple organic stricture, 109 were successfully treated by means of catheterism, warm baths, and opium; and in 20 cases only, or in 15.8 per cent., were any other operative measures called into requisition. In all of these 20 examples the bladder was punctured per rectum, with complete success.

Out of eight cases, also, of retention of urine, produced by the gradual contraction of a *traumatic* stricture, five were treated by means of catheterism; and in the remaining three the bladder was required to be punctured; the proportion of cases requiring such an operation for its relief in traumatic stricture being much greater than in the preceding class of simple organic stricture, the causes of this difference being very apparent. If a surgeon is called to a patient suffering under the agonies of a retention of urine, produced either by a simple spasmodic stricture or an inflammatory stricture, it has been already explained that relief is to be obtained by the cautious introduction of a catheter, aided, if required, by the use of the warm bath, or a full dose of opium; and, in certain cases, by the inhalation of chloroform.

If these means should fail, as experience proves may be the case, either from some peculiarity of the stricture, or from the manner in which the treatment has been carried out, other measures will necessarily be called into requisition; and it has been already stated that the best and most expeditious practice is to puncture the bladder through the rectum. It is true that this practice is rarely needed in simple spasmodic, or in inflammatory stricture, the means already suggested being, in the majority of cases, amply sufficient to secure relief; nevertheless, in the exceptional instances this operation is of great value, and I possess the notes of cases illustrating the fact. It must be remembered, however, that the practice is only called for when simpler means have failed; but when this difficulty is experienced, the operation is to be performed.

In the treatment of retention of urine with simple organic or traumatic stricture, the same principles of practice are to be applied as have been recommended in the former class of cases; and in a large proportion of instances it has been already shown that success by such treatment may be secured; for, out of 137 cases of retention admitted into Guy's, operative measures were required in only 23. The simple introduction of a catheter, with the aid of warm baths and the internal administration of opium, proved sufficient to carry out all the objects required, and relieved the retention in 114. If the surgeon is called, therefore, to a case of retention of urine with organic stricture, the introduction of a catheter is the primary means to be employed. If the history informs him that the retention is the result of a gradually contracting passage, a medium-sized instrument should be selected, and, on this failing, a second attempt with a smaller one may be followed by success. Force, however, is not to be employed, and too much time is not to be expended in making the attempt; if success is to follow the operation, it will readily be obtained; perseverance and repeated endeavors to pass an instrument, as a rule, do harm. If the symptoms are not very urgent, and some delay may be allowed, the warm bath and a full opiate, such as two or even three grains of opium, may be employed; and, under their combined influence, it will be only in the exceptional cases that relief will not subsequently be secured—the patient either micturating with his own free will, or the introduction of a catheter will be rendered possible.

If the symptoms of retention are, however, very urgent, and the agonies of the sufferer demand immediate relief; or, if the means which have been just described have been fairly tried and have been found wanting, there

is little doubt that the practice which is most scientific, and most certain, is the puncturing of the bladder through the rectum; for all experience has correctly indorsed the opinion which was expressed by Mr. Cock, when he recalled the attention of the profession to this operation, in his valuable paper, published in 1852 (vol. xxxv of the "Med.-Chir. Trans."), "that the bladder may be reached with the smallest amount of pain, with the least risk of present or future danger, and with the greatest prospect of ulterior good, by puncture through the rectum."

The records of the cases of this operation which I possess positively prove, if further proof be necessary, the truth of this opinion, and it is gratifying to find that, in these days, the majority of surgeons recognize the value of the practice.

The operation is as simple as it is safe; it is as efficient as it is scientific; and as a means of relieving any patient from the agony of a retention of urine which has been proved to be irremediable by the *rational* use of catheters, it stands unrivalled. By its adoption all forcible catheterism, with its dangers, are dispensed with. Perineal section and its difficulties, as a remedy for retention, are done away with; and the operation of puncturing the bladder above the pubes may nearly be forgotten. Puncturing the bladder through the rectum embodies in itself all the advantages of these means without any of their evils; and on practical grounds it commends itself for our adoption.

I would add, therefore, as a final conclusion: "That in all cases of retention of urine from stricture, in which relief cannot be given by means of rational and not forcible catheterism, and in which the use of the warm bath and opium have failed, the operation of puncturing the bladder through the rectum is to be performed."

Extravasation of Urine in Children and Impacted Urethral Calculus.—It has been already explained how retention and extravasation of urine in the *adult* may be produced by the mechanical obstruction of a urethral stricture. It remains for me to show how in children the same effects ensue from a mechanical obstruction of a very different kind. I allude to the obstruction caused by a urethral calculus.

A vesical calculus, when small and when ejected from the bladder, may become lodged or impacted in any portion of the urethra, and give rise to every degree of difficulty of micturition, even to a retention of urine and extravasation. In adult life I have never seen extravasation occur as a result of impacted urethral calculus, although I have seen complete retention; but in infancy and childhood, almost all the examples of extravasation of urine that have passed under my observation have been the product of such a cause. I have seen it in an infant fourteen months old, and in many others older.

The cases come under the surgeon's notice as examples of retention; and if there is no condition of the penis present such as phimosis, paraphimosis, or adherent prepuce, by which this symptom may be produced, there is a strong probability that a urethral calculus is the cause.

Extravasation of urine in childhood is almost invariably the result of an impacted calculus. The calculus is also usually arrested in the perinæum. It rarely passes into the penis.

If the calculus can be removed by forceps this practice is the right one to adopt; it is, however, rarely successful. Where these means fail, the stone must be excised. When extravasation has taken place, the urethra must be opened in the perinæum by a free incision upon a grooved staff. The stone is sometimes lost in the sloughing tissues.

By way of summary of the causes of retention, it may be stated that

retention in a *male child* is usually due to a urethral calculus, phimosis, paraphimosis, adherent prepuce, or the mechanical obstruction caused by a piece of string, &c. In a *female*, to ulceration about the meatus, or adherent labia. Retention in the *young adult*, to stricture, obstruction of the urethra from stone, gonorrhœa, perineal, anal, or prostatic abscess, or rectal disease. In the *aged*, from enlarged prostate or atony of the bladder.

Retention from fever or general nerve shocks may occur at all periods. In women, hysterical retention may also occur, and retention from other uterine causes.

On Puncture of the Bladder.—In all cases of retention of urine, in which relief cannot be afforded by the introduction of a catheter, and the nature of the obstruction is not such as to require the operation of urethrotomy, puncturing the bladder through the rectum is the right operation to perform, for by it relief can be given with rapidity, certainty, and safety.

In former times, the bladder used to be punctured from the perinæum, but such a clumsy operation is not now recognized amongst surgical proceedings. At the present day, some surgeons prefer tapping the bladder above the pubes, but in safety and efficiency the operation is not to be compared to the one I am now recommending, for, in the words of its modern advocate, Mr. Cock, "The operation is safe, easy of accomplishment, and without danger as to its consequences. In cases of retention which resist ordinary treatment it is greatly to be preferred to long-continued attempts at catheterism, which, whether successful or not, must be infinitely more injurious to the urinary organs than the simple and almost painless operation of tapping."

"I consider," writes Cock, "that the benefit of the operation consists, not merely in the immediate relief given to the patient, but also to the opportunity which it affords, by the retention of the canula in the bladder through an indefinite period, of diverting the flow of urine from its ordinary channel, and thus giving quiet, freedom from pain, and the natural means of restoration to the maimed, irritable, or diseased urethra. I conceive also that the bladder might be tapped with advantage in cases of obstinate stricture, in which retention of urine does not actually exist."

These views, published by Mr. Cock in 1852, "*Med.-Chir. Trans.*," and "*Guy's Reports*," 1866, I cordially indorse. The practice of Guy's Hospital, for the last twenty years, to my knowledge has only confirmed their accuracy, and the more I see of the operation the more I like it. The objections raised against it are theoretical and not practical, for abscesses between the bladder and rectum, persistent fistulous openings, injury to the seminal vesicles, and wounds of the peritoneum, do not commonly occur; they are said to have done so in exceptional instances, but such must, indeed, be very rare.

Mr. Cock, in his large experience, has known but one bad result to follow the operation, and that was atrophy of the testicle, from which he infers that the vas deferens was wounded. At Guy's, from the carelessness of a house-surgeon, a fatal peritonitis once followed the operation from the perforation of a coil of intestine, the puncture having been made too far back; but eliminating carelessness—a cause of half the errors in surgery—the operation is a very safe one.

The only requisite is a moderately full bladder, and this is always present under the circumstances which call for the operation. An enlarged prostate is no real obstacle to its performance, for this, if necessary, may be perforated with impunity.

The operation is performed as follows:

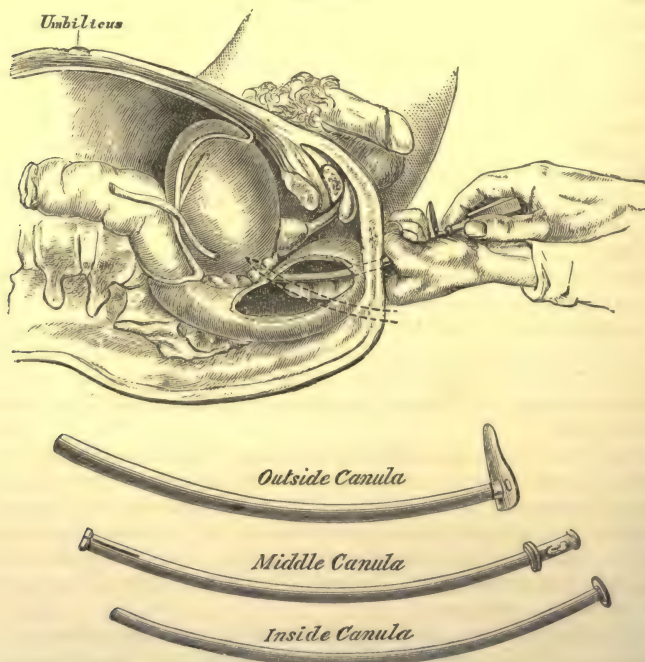
The best instruments are those suggested by Mr. Cock. The long curved

trocar and canula, as originally employed, are inefficient instruments; indeed, many of the objections to the operation are, probably, traceable to their use. Cock's instruments consist of a canula six and a half inches long, a blunt pilot trocar, and a sharp trocar; a second tube, with an expanding end to keep the canula in position; and a third to maintain the second in position (Fig. 260).

The patient is to be placed and held in the position for lithotomy, and brought well to the edge of the bed. The operator is then to introduce the index finger of the left hand into the rectum, with the palm upwards, and to feel for the prostate (Fig. 260), and, if possible, for the bulging base of the tense bladder beyond it. Some little pressure above the pubes may help him in this attempt. The pulpy point of the index finger is then to be held in the median line, just below the spot at which the puncture is to be made.

The surgeon, with his right hand, is then to take from his assistant the canula, well oiled and fitted with the blunt pilot trocar, and introduce it into the rectum upon his left index-finger, passing it well up to the point selected for puncture. He is then to steady the canula and hold it firmly in position with the thumb and three outer fingers of his left hand, and withdraw the blunt trocar. The sharp trocar is then to be introduced through the canula, and having reached its end, the handle with the canula is to be depressed and then driven home, in a direction upwards and forwards, *in a line towards the umbilicus* (dotted line Fig. 260). The bladder

FIG. 260.



will in this way be entered, the free end of the instrument moving freely, and all resistance ceasing.

The trocar should then be withdrawn, and the canula pressed well home.

Before the bladder is completely emptied, it is well to insert the two inner canulæ, and fasten the whole in by means of tapes, two passed in front and two behind the thighs, and fastened to a girth round the waist.

The canula may then be plugged with a peg to retain the urine, or with a hollow plug inserted into a piece of india-rubber tubing, through which the water may drain away.

As soon as the urethral passage has become pervious to a catheter, the canula should be withdrawn; this condition taking place usually within a week from its introduction. The stricture may then be treated on rational principles by dilatation; indeed, it is very remarkable how at times a stricture which has thus been left alone and unirritated by catheterism or ineffectual natural efforts at micturition seems to give way under such treatment, and a thoroughly impervious indurated urethra becomes pervious and amenable to simple measures.

In retention of urine from enlarged prostate such an operation as this is rarely called for; it is necessary, however, at times. I have had occasion to do it on three occasions where the neck of the bladder and prostate gland had been seriously injured from rough catheterism, with such good success that I shall never hesitate to do it again when any difficulty exists in entering the bladder, or in subsequently keeping an instrument in the bladder. In two of the cases mentioned the irritability of the bladder was so great as to resent the presence of an instrument, and the pain and difficulty in its passage were so severe as to be nearly unendurable; in both these cases the operation was followed by speedy and permanent relief. The bladder recovered its healthy condition after the parts had had rest for a few days, the urethra allowing of catheterism without distress, and convalescence was soon established.

The surgeon may perform this operation, then, without fear in all cases of retention where any difficulty in catheterism exists. I know of no operation, attended with equal good, that is so safe, satisfactory, or so free from danger.

In all cases of supposed retention of urine the surgeon should guard himself against falling into the error of mistaking suppression for retention; as in all cases of supposed incontinence he should remember that it may be due to retention and overflow.

CHAPTER LVI.

AFFECTIIONS OF THE PENIS.

THERE is probably no part of the body which varies more in its conformation than the penis, and where any congenital defect is more likely to be propagated. The elongated and contracted prepuce is particularly hereditary, and the whole of the male branches of a family may be the subjects of it. I have known this to be the case in many instances, and in one family where five sons suffered from it, their father had also done so.

Phimosis, or a long and contracted prepuce, is, therefore, a *congenital* affection, but as often as not it is an *acquired* one, the result of inflammatory thickening and subsequent contraction, the consequence of some preputial chancre, venereal, or other affection.

So long as the prepuce is only long, and the glans can be uncovered for

purposes of cleanliness, and when the organ is in a state of erection, operative interference is not called for, although it is well to impress upon nurses the necessity of paying attention to the infant's penis, and of cleaning it daily; for a want of such attention is frequently the source of urinary trouble and penile irritation. When neglected, the secretion of Tyson's glands collects behind the corona, and acts as an irritant; the prepuce and glans penis constantly become adherent, and set up bladder irritation simulating stone (*vide* chapter xlvii). In some neglected cases an acute inflammation is induced, followed by œdema of the prepuce and the secretion of pus, which simulates gonorrhœa, and which too often suspicious minds have interpreted as such, much to the injury of nursemaids and others in whose charge the child rested. This disease is essentially a balanitis, and is readily cured by cleanliness. In the adult a long and narrow prepuce is injurious, as it is a bar to proper cleanliness, often interferes with coitus or renders it painful, and is probably an exciting cause of cancer of the organ where a disposition to such an affection exists. In boyhood it probably sets up an irritation in the parts that induces a habit which ends in masturbation. It often gives rise to incontinence and may produce retention of urine.

TREATMENT.—When the narrowing is not great, the daily retraction of the prepuce over the glans for purposes of cleanliness is generally sufficient to dilate the orifice, care being taken to replace it subsequently. Dr. Cruise's plan of dilating the orifice mechanically is not a satisfactory one; I have given it a trial and rejected it. The suggestion also of making two lateral partial sections of the mucous membrane has in my hands met with the same fate. Neither of these methods is so successful as to warrant its being recommended.

When phimosis exists, congenital or otherwise, it is, as a rule, best treated by circumcision; in exceptional cases, where a narrowing of the prepuce is more marked than an elongation, the prepuce may be slit up (Fig. 261), but in children circumcision is the better operation. In some instances, however, where the penis is very short, the fault resting more in the penis itself than its skin covering, circumcision should not be performed, for I have known, under these circumstances, the operation to fail, even when well done and repeated; the prepuce should rather be slit up to the corona instead, and its mucous covering turned well back and fixed to the skin.

In minor cases the *slitting* plan is to be carried out; the skin and its mucous lining being divided in the middle line, either by the introduction of a bistoury guided by a director beneath the prepuce, or by means of a pair of sharp scissors. The surgeon should be careful, in doing this, to divide the mucous membrane *right back to the corona*; in the adult he should then turn the two flaps backwards, and fasten the mucous to the skin flaps by means of some fine sutures. In the infant there is no necessity to stitch. When the prepuce requires division to expose a sore or some warty growth the above plan should be selected.

Circumcision is an operation that requires great nicety; it fails if sufficient skin is not taken away, and it fails if the mucous covering of the glans is not fully divided up to the corona; it fails, likewise, when too much skin is removed. The following is the plan I have for years adopted and taught, and I think it better than any other. I have never known it to fail if properly carried out:

The first point is to decide how much skin is to be removed, and this can satisfactorily be determined by applying a pair of long dressing forceps to the penis—which should be allowed to rest in its natural position—on a level with its corona, and closing them as soon as the glans penis has been

allowed to slip backwards. The integument in front of the forceps may then be amputated with a scalpel (Fig. 262).

FIG. 261.

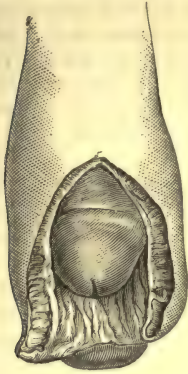
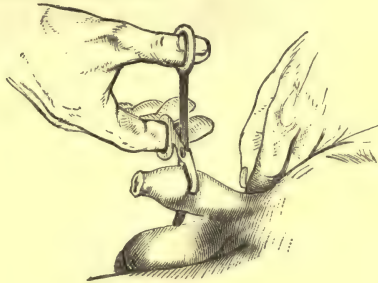


FIG. 262.



The forceps are now to be taken away and the mucous covering of the glans is divided in the middle line, well up to the corona, as in the slitting operation, and turned backwards, the two flaps being stitched to the skin by fine sutures. In adults a fine uninterrupted suture is probably the best; in infants a strip of dry lint wrapped round the parts is all that is required.

The glans penis in both these operations should be completely separated from its mucous covering, all secretion removed, and the frænum, when short, divided.

By adopting these suggestions the student has a definite guide to aid him in the removal of the skin; he has none if the end of the foreskin be drawn out as usually recommended, or when trimming up the prepuce after slitting it up.

Paraphimosis is said to exist when a tight prepuce has been retracted behind the glans, and has not been replaced. It produces a strangulation of the glans, and a strangulation of the mucous lining of the prepuce, with œdema. When relief is not obtained ulceration in the line of strangulation is induced, and even sloughing of the parts.

In children it follows the accidental retraction of a narrow prepuce; in adults it is generally due to the mechanical retraction of the prepuce during coitus, and the neglect to reduce it. It may be associated or not with some venereal complication.

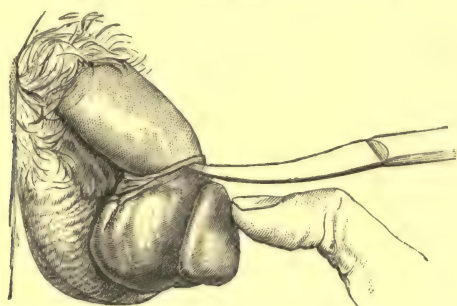
TREATMENT.—The object of the surgeon is to reduce the glans behind the narrow prepuce that is strangulating it; and failing to do this by other means, he must divide the constricting preputial orifice, and allow the parts to recover themselves.

To carry out the first object, which can, as a rule, be done in recent cases before the œdema is great, both in children as well as in adults, chloroform should be given, and the patient placed on his back.

The surgeon should then take the penis between the index and middle fingers of his two hands, which are interlocked, and pull the prepuce forwards, and with his two thumbs placed upon the glans forcibly press upon it backwards; the pressure of the thumbs, and counter-pressure with traction of the interlocked fingers, so pressing out the fluid from the œdematous tissues as to allow of the reduction of the paraphimosis. When the œdema is very great, a few punctures with a needle or lancet facilitate the opera-

tion. When the affection has been of some days' standing and ulceration exists, and when failure has followed the attempt at reduction, the strictured preputial orifice must be divided; but the band is not to be looked for directly behind the glans, but behind the roll of œdematous prepuce that surrounds it. This is best done by a scalpel, and a cut half an inch long made in a vertical direction over the constriction, with the thumb of the left hand placed on the glans penis and forcibly depressing it (Fig. 263). The pre-

FIG. 263.



puce yields at times audibly and the wound gapes; the whole constricting medium should be divided. In children after the paraphimosis has been reduced and the œdema has subsided, it is wise to have circumcision performed; indeed, in the adult the same practice is frequently desirable. Water-dressing or some lead lotion should be applied to the parts subsequently to assist recovery. In all case of *œdema of the penis* in children the surgeon must remember that it may be due to the mechanical strangulation of string.

Warty growths are very common on the penis and prepuce; they may be found fringing the orifice of the prepuce, the orifice of the urethra, or growing from any part of the mucous membrane between these two points; indeed they may grow from within the urethra as well as from the outside skin of the prepuce. They have in the bulk of cases a venereal origin, that is, they have been caught by contagion, for warts are contagious; but they at times occur without any such cause in men who have long prepuces, and who are not sufficiently careful in local cleanliness. Their excision is the only successful treatment when they are numerous, nitrate of silver being applied to their bases; in less severe examples the dry oxide of zinc, freshly powdered savine and calomel, are good local applications, the warts rapidly withering under their influence.

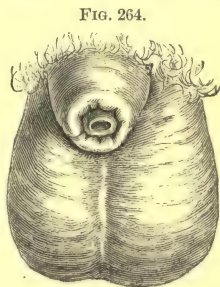
Cancer of the Penis.—In the middle-aged and old it is sometimes difficult, if not impossible, to distinguish simple warty growths from the cancerous; the greater obstinacy of the cancerous and their disposition to bleed are probably the best points for distinction, but they are by no means constant.

When ulceration complicates the case cancer is probably the cause. If the disease be left to take its course, the glans penis and prepuce become infiltrated with cancerous material; the warts discharge a fetid ichorous secretion, the parts break down and ulcerate, adding to the fœtor; the inguinal glands become involved, and death takes place from exhaustion; the cancerous ulcer at times eating away the whole organ and involving the scrotum.

This form of cancerous disease is generally the epithelial, true carcinoma being comparatively rare.

TREATMENT.—In all clear cases amputation is the only sound practice, and in doubtful ones it is the wisest. Nothing less than amputation is of any use in cancer when the glans is affected. When the prepuce alone is involved the excision of the growth is sufficient. In both cases the surgeon should cut quite free of the disease, for the tissues about it are probably more or less infiltrated with cancerous products. I have a patient alive and well now whose penis I cut off for cancer six years ago, and a second from whom I excised a cancerous mass from the prepuce seven years ago.

Amputation of the Penis.—Since I have had the galvanic cautery in use I have used nothing else for amputation of the penis. The platinum wire is to be passed round the penis and made tight with the *écraseur* screw. Connection with the battery is then to be made, and the wire screwed home; the heat not being too intense, and the surgeon not being in too great a hurry; for if the tissues are divided too rapidly hemorrhage will take place. Under ordinary circumstances the operation is absolutely bloodless and the pain afterwards is little or nothing. After the penis has been removed, it is wise to slit open the urethra for about half an inch and turn its two edges outwards, fastening them with sutures. This may be done at the time of the operation, or during the first week. This step is required to prevent the contraction of the urethral orifice that may otherwise ensue. The cautery is not, however, always to be had, and when it cannot the knife should be used.



The old operation consisted in the removal of the organ by one clean sweep of the bistoury, an assistant having steadied and compressed the base of the organ by a band of tape. The modern improved operation, which, I think was suggested by Hilton, consists in the introduction of a narrow bistoury between the spongy and cavernous bodies and the primary division of the latter, the spongy body with the urethra being divided about half an inch more forward. The object of this is to make the urethra stand out from the stunted organ, and thus facilitate micturition. It is without doubt the best mode of amputating a penis. To prevent any tendency in the urethra to contract it may be slit open or stitched back to the preputial skin. Fig. 264 illustrates the stump after amputation.

Clover's clamp for compressing the penis during the operation is a very excellent one and ought to supersede the tape.

Other Tumors of the Prepuce.—The prepuce may be the seat of *fatty*, *sebaceous*, or even *fibrous* tumors; but these are rare. It is not uncommonly the subject of what has been described as *elephantiasis*, although when the penis is involved the scrotum is usually similarly affected. I have, however, seen one case, in a man aged thirty-five, in which the penis was thus alone affected. The organ was immense, and frightful to look at. The man came to me with a gonorrhœa; admitting, however, that he had never been able to have true coitus since the disease had existed—about four or five years. He was too proud of it to have anything done to it. When in repose the penis was eight inches round and six long.

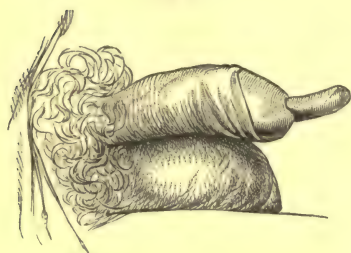
The disease is a chronic hypertrophy of the skin and cellular tissues. Nothing but the excision of the redundant integument is of any use.

Injuries to the Penis.—These are not common, excepting the minor in-

juries of laceration of the frænum or prepuce produced in coitus. Incised wounds, however, are occasionally met with—the products of insanity, jealousy, or malice; they require careful adaptation with sutures. The body of the penis, however, at times becomes the seat of injury from some rough bending of the organ during connection or otherwise; and as a consequence when the immediate effects of the injury have passed away, strange symptoms appear. Thus, some years ago I was consulted by a gentleman whose penis when turgid arched on one side, the cavernous body of the other side having atrophied and become a mere gristly mass. This condition had followed an injury received in coitus many years before; some great induration had existed for months in the cavernous body that had subsequently atrophied.

More recently I have seen a married man, about 60, who a year before “missed his mark” in coitus, and hurt his penis; an induration followed,

FIG. 265.



and at the present time where this existed a deficiency of tissue can be felt. When the penis becomes turgid it is never straight but bent laterally. A singular case of injury to the penis occurred at Guy's in 1867 in the practice of Mr. Hilton; it was in a man æt. 50, who when nineteen had had his penis bitten by a stallion. After the accident some little bleeding occurred, and a fleshy cylindrical body projected from the urethral orifice an inch and a quarter long and one third of an inch in diameter. It was evidently the corpus spongiosum that had been divided by the horse behind the glans penis and become everted. When admitted the corpus spongiosum urethræ terminated abruptly about one inch behind the glans penis; the urine flowed by the side of the protrusion. The drawing above shows the condition of the parts on admission.

Malformations of the Urino-genital Organs.—These malformations of the urino-genital organs are more common in the male than the female subject, and show themselves in many degrees of severity. Thus, when the upper surface of the urinary passage from the orifice of the urethra to the fundus of the bladder is deficient, a case of *extroversion of the bladder* or *ectopion vesicæ* is said to exist; when the urethra alone is deficient at its upper part, *epispadias* is the term employed. Some authors apply the latter to the more complete condition as well. With this imperfect condition a separation of the pubic bones frequently exists, and some malformation of the scrotum, this sac being often bifid, though containing the testicles in proper position; at times a hernia complicates the case. When no testes are present and the scrotum is bifid, the question as to sex often arises, for in the female the vagina is frequently absent or so small as more nearly to represent a urethra than a vagina.

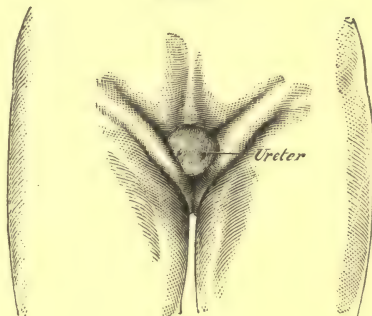
In Extroversion of the Bladder the posterior wall of the bladder appears as a red mucous mass below the umbilicus, which is lost in the upper border of the deformity. At the lower part of its surface the orifices of the ureters may be often seen as small nipple-like projections; in some instances these orifices are lost in the pelvic chink, although they may be brought into view by depressing the fissured penis or what represents the penis, for this will probably appear only as an expanded glans penis and a pendulous prepuce, the cleft urethra being visible in pulling the parts down and becoming lost in the pelvic fissure (Fig. 266).

In the female subject the exposed urethra will be seen between the two labia. When the vagina is present it will open at its upper border and appear continuous with the lower labia. (Fig. 267.) At times, although very rarely, the epispadias involves only the urethra. I have seen but one case of this; in it the exposed mucous surface of the urethra passed backwards towards the pubes into a fissure, which was covered in by a thin transverse fold of skin, from beneath which urine flowed. The scrotum was large but bifid, and contained the testes ("Guy's Hosp. Rep.," 1868).

FIG. 266.



FIG. 267.



TREATMENT.—The chief annoyance connected with this deformity being due to the constant dribbling of the urine as secreted, induced Messrs. Simon and Lloyd to carry out an ingenious operation by which the urine might be carried into the rectum, and the fissure subsequently closed, but the operations failed and have not been repeated. For particulars the reader may refer to the "Lancet" for 1851 and 1852. Holmes has suggested a modification of Simon's plan, and it is probable that it is in this direction that some good may eventually be found.

Other surgeons have, however, devised means by which the exposed mucous covering of the bladder may be covered in, in this way adding to the comfort of the patient; and of these Wood of King's College has been the most successful. He has operated in ten such cases, Holmes in five. I have operated in two only. Four of Wood's succeeded completely; three of Holmes's; and one of mine, the others being partially successful. The operation consists in bringing up flaps of skin from either side of the fissure and covering it in, fastening them together by sutures. For full details, *vide* "Med.-Chir. Trans.," vol. lii, and Holmes's "Surg. Dis. of Child.," 1868. In a case now under treatment I have destroyed the mucous membrane with the cautery, and thus turned it into a cicatrix, having avoided the ureters.

Hypospadias is said to exist when any deficiency of the under surface of the urethra is present. In the larger number of cases the urethral orifice is placed below the glans at a spot corresponding to the preputial frænum. In a certain number of these cases there is a depression in the glans penis corresponding to the natural outlet, and several small depressions often exist between the urethral orifice and the cup-like depression at the extremity of the glans. One or more foramina through which urine escapes also sometimes present themselves below the true opening of the urethra. The urethral opening is often small and requires enlarging.

In more extreme cases the urethral orifice appears at the base of the

penis, and, under these circumstances, it is commonly associated with a bifid scrotum. When the testes are absent the question of sex is raised. In a case I saw in 1867 the sexual passion was so strong that the man came to me to ask for castration, as he was unable to copulate on account of the stunted condition of his penis, and the way in which it was held down by a band, causing the penis to arch downwards under excitement. He had testitis at the time from ungratified passion. Nothing can be done for these cases.

CHAPTER LVII.

HYDROCELE OF THE CORD AND OF THE TESTICLE, AND HÆMATOCELE.

HYDROCELE, or a collection of fluid in close connection with the testicle or spermatic cord, is a term which surgeons have been in the habit of applying to two very different classes of cases—to cases which differ in their progress as well as in their pathology, agreeing only in the one marked and prominent symptom to which the term hydrocele has been applied. For clinical purposes this comprehensive word may perhaps have certain advantages, and with this view it may still be employed, although in a scientific sense it is certainly to be condemned.

Accepting the term hydrocele, therefore as signifying a collection of fluid in close contact with the testicle or spermatic cord, two great divisions of the subject at once suggest themselves, namely, hydrocele in some portion of the tunica vaginalis, either of the cord or testicle, and hydrocele as represented by an expanded and newly-formed cyst, this cyst being as a rule in connection with the epididymis, and but rarely with the body of the testis. The term *vaginal* hydrocele is applied to the former class of cases, and *encysted* to the latter.

It is well known by all physiologists that the testicle in its descent from the loin during fetal life draws with it into the scrotum two layers of peritoneum, both passing through the internal and external abdominal rings in front of the cord and its attendant nerves and vessels, both also passing into the scrotum, the posterior layer being in close connection with the fibrous capsule of the body of the testicle—the tunica albuginea—and the anterior in connection with the purse or scrotum. In a perfectly normal condition it is generally supposed that at birth, or shortly after, the two surfaces of these serous membranes close and become connected, the canal which was at one time present ceasing to exist, and becoming a closed and withered channel, from the internal abdominal ring to the upper portion of the testicle. In the scrotum, however, the two serous surfaces are supposed to be permanently free, for the purpose of allowing easy and ready mobility of the testicles in their scrotal covering. That the latter part of this supposition is correct there is little room to doubt, for all anatomical and pathological investigations tend to show that such is really the case; but it is not so clear that the former hypothesis is equally true, for it has been ascertained that the prolongation of the serous membrane down the inguinal canal and into the scrotal sac remains patent for a longer period than has been generally supposed, and that in some cases it continues more or less as a pervious canal during the whole of life. Mr. Birkett has demonstrated the fact, in his investigations on hernia, for he has shown that in a large

proportion of the examples of oblique inguinal hernia the bowel descends into the open vaginal process of the peritoneum, which passes down to and covers the testicle.

The following anatomical facts in connection with this subject may, then, with some confidence be laid down :

That the opening into the peritoneal cavity at the internal ring is frequently open at birth and during the whole of adult life.

That the vaginal process of the peritoneum may remain as a more or less open canal during childhood, and even up to old age ; and that this tube may extend partially or wholly through the inguinal canal, and even into the scrotal vaginal sac.

That this naturally-formed peritoneal tube and sac may be closed at the internal or external abdominal rings, or at any intermediate spot between these points, or at its junction with the testis.

As a consequence, it is tolerably clear that a collection of serous fluid may take place in any part of this prolonged serous channel, and that a hydrocele of the cord or testis of different kinds may be produced.

We thus find, during infant and early life, that a serous exudation may take place into the scrotal portion of this peritoneal sac, which is in direct communication with the abdominal cavity, from a want of closure at the internal ring or at some other part of its course. To these cases the term *congenital hydrocele* has been applied. In others, the serous effusion may be arrested at the external ring or at the upper portion of the testis, when a *congenital hydrocele of the cord* is said to exist. At early as well as at late periods of life the serous effusion may be confined to the scrotum, and may not extend higher than the external ring, this being the ordinary condition of *simple vaginal hydrocele* ; in other instances, however, it may extend more or less up the canal, even as far as the internal ring.

In another class of cases the serous fluid may be confined between the internal and external rings, giving rise to the so-called *diffused hydrocele of the cord* ; and when it occupies a still more restricted space, it is usually described as an *encysted hydrocele of the same part*.

The pathology of all these different conditions remains, however, the same, these differences in position being accidentally determined by the extent and lines of adhesion, or by closure of the peritoneal testicular prolongations.

Figures 161, 162, and 163, given to illustrate the subject of hernia, p. 302, may be referred to with advantage.

The Pathology of Hydrocele.—As a general rule, it may with considerable confidence be asserted that the secretion of the serous fluid which gives rise to the ordinary vaginal hydrocele is due to some inflammatory affection of the serous membrane ; for in certain cases pure flocculi of lymph may be seen floating in the secretion, and in others spontaneous coagulation of the same may occasionally be observed. The thickening of the tunica vaginalis, which so frequently takes place in cases of long standing, and the presence of membranous bands and septa in the cavity of the serous sac, point likewise to the same conclusion. This opinion gains support also from the fact that this form of hydrocele may be produced by extension of the inflammatory action from some portion of the epididymis or of the body of the testicle.

In another, although a smaller class of cases, it is not, however, so clear that an inflammatory action has any influence in the production of the serous effusion, for it would rather appear as if in these instances the exudation was of a passive nature, being merely an excess of the natural secretion of the serous membrane. It is to the congenital form of hydrocele

that these observations are more particularly applicable, to that in which a communication still exists between the abdominal peritoneal cavity and the scrotal serous sac; in many of these cases the fluid rapidly disappears under tonic treatment, the passive effusion being reabsorbed as the powers of the patient improve, and *vice versa*.

The fluid of a vaginal hydrocele is invariably albuminous, for the secretion of all serous membranes contains albumen in solution, and under the influence of an inflammatory action this is markedly increased; hence the amount of albumen in the fluid of a hydrocele is determined by the nature and violence of the inflammatory action. We thus in some cases, as in the congenital variety, find it as a thin, serous, and saline fluid, slightly tenacious and albuminous, and of a clear color, the fluid varying in no single point from the natural serous fluid of the peritoneal cavity. In others, again, it appears of a more tenacious character, varying in hue from a pale amber to a deep straw; in some examples it will be stained with blood, in others it may hold cholesterin in suspension, at times being perfectly opaque and syrupy from the presence of such matters. It is, however, in the old and chronic cases only that these last conditions are to be observed.

In the so-called *acute vaginal hydrocele* more or less fibrin will invariably be found either in solution or in the form of false membrane or adhesions between the two surfaces of the serous membrane; and in the *chronic* examples the walls of the cyst will be found to have undergone great changes, the thin clear membrane becoming thick and opaque, from the organization of the inflammatory product poured out into its tissue; while upon its surface this membrane presents a firm fibrous appearance, and in certain cases contains cartilaginous or ossific deposits. In rare cases suppuration has been observed to occur in the tunica vaginalis, but this result is beyond my experience, except as the effect of some external irritation or plan of treatment which had been adopted for its cure.

Uncomplicated hydrocele, or a simple effusion into the tunica vaginalis, unassociated with any disease of the testis or epididymis, is generally a painless and insidious affection; it attracts attention mainly by its size, and demands treatment chiefly from the mechanical inconvenience caused by it. It is generally of slow progress, and, as a rule, will be found to have existed for many months when coming under the notice of the surgeon; the patient seeking advice only when the organ has become cumbersome, and from its weight has excited some pain and dragging in the lumbar region.

The Clinical Examination of a Hydrocele.—On examining a testicle, the seat of this disease, the enlargement will be found to occupy the position of that organ which it includes; the swelling will be found also to be free and readily movable. On inquiring into the history of the case, it will be learnt that the swelling appeared primarily in connection with the testis, gradually encroaching upon the upper portion of the scrotum towards the external ring, and on careful examination the cord will generally be distinguished above the tumor clear and distinct. In exceptional cases, however, it should be observed, the fluid will be found to pass upwards through the external ring, and up the cord as far as the internal ring; in such examples it is tolerably clear that the peritoneal testicular process has been closed only at one point, and that is at its internal abdominal opening. On taking the tumor in the hand it will be found to be light, and on passing the fingers over its surface it will be felt smooth and uniform. Fluctuation will also readily be detected on the slightest and most delicate palpation. The position of the testicle should then be looked for and made out; its natural site being somewhat posterior, and in large tumors towards the upper part. But it must be borne in mind that, in certain examples, the

testicle may be in front of or below the tumor; that is, in cases in which the organ is misplaced. The best test of its presence is afforded by manipulation; the peculiar testicular pain felt on the application of pressure affording a certain indication. The question of translucency should next demand the notice of the surgeon, for when present it is of peculiar importance, as indicative of the vaginal hydrocele; but it must be remembered that it is not an invariable symptom; for it is neither present in cases of hydrocele in which the fluid is thick, bloody, or opaque, nor when the walls of the vaginal tumor have become thickened by fibrinous deposit.

It should be added that, for this translucency to be well observed, the integuments of the scrotum should be firmly stretched over the scrotal enlargement.

The tumor is generally described as being of a regular and pyramidal shape, but this condition is very variable, for the shape of the swelling depends upon the openness of the tubular peritoneal membrane of the cord, and the connection which exists between the surfaces of the tunica vaginalis testis and tunica vaginalis scroti. When the canal has closed and withered down to the body of the testis, the swelling will be more or less globular; and the higher the point of closure of the vaginal peritoneal sac towards the internal ring, the more pyramidal will the watery swelling necessarily become. Should adhesions exist between the two layers of serous membrane at the lower portion of the testis, the hydrocele will appear to be at the upper part; and when the natural contraction between the tunica vaginalis of the cord and of the testicle is not completed (Fig. 163), an irregular or even hourglass contraction may make its appearance—the outline of a hydrocele depending much upon the anatomical conditions of the part in which it is situated, and the pathological changes which may have resulted from the affection. The true pyramidal swelling is best seen in children, when the fluid will be found frequently to pass well up the cord. In adults it is certainly far from common.

Hydrocele occurs at all ages, but it is somewhat common at birth and middle age, and the following analysis of my own cases well bears out the investigations of Curling and others on this subject. In a large proportion of cases, hydrocele appears as a one-sided affection, but it seems to affect the right or left testis indiscriminately. Curling tells us that of 115 cases 65 occurred on the right, 44 on the left side, and 6 were double; whilst of my own 117 cases, consecutively observed, in which these facts were noted, 41 occurred on the right side, 62 on the left, and 14 were double, and these results coincide with the opinions of Velpeau, Gerdy, and others.

By way of summary it may be said a chronic vaginal hydrocele appears as a painless swelling, and as an apparent enlargement of the testicle, of slow and unequal growth, and of variable size, with a smooth and uniform surface, and more or less tense and fluctuating feel; it is invariably movable within the scrotum, and, as a rule, it can be clearly demonstrated to be distinct from any abdominal connections. The presence of the testis can generally be made out at its posterior and upper portion by the testicular pain on pressure, or by the absence of translucency at one spot—the tumor, as a rule, transmitting light when its scrotal coverings have been well stretched. It has a tendency to remain tranquil for many years, and by age simply increases in size, occasionally growing to enormous dimensions, when the penis becomes buried within the swelling; it never proves dangerous to life, and causes pain and requires treatment mainly from mechanical causes.

Symptoms and Diagnosis of Hydrocele of the Cord.—It has been already briefly explained how a hydrocele of the cord may be produced, and under

what circumstances it may appear as a *diffused* or as a so-called *encysted* tumor. It has likewise been shown how these two conditions are but modifications of the same disease, the diffuseness or isolation of the affections being determined by the adhesion, or more or less complete closure of the vaginal process of peritoneum as it passes downwards into the scrotum.

It may appear as a *congenital hydrocele* of the cord, from a want of closure of the abdominal orifices of the vaginal peritoneal process, the serous fluid in such an instance gravitating downwards as far as the external ring, the original canal at this spot having been naturally closed; or it may present itself to our notice as a so-called *diffused hydrocele* of the cord, either at an early or late period of life, from a collection of serous fluid between the closed abdominal orifice of the vaginal process and the upper portion of the testis, the fluid being either arrested at the external ring, or passing through it to the upper portion of the testis. In a third class of cases it may appear as a small isolated bag of serous fluid situated between any of these points, movable with the cord and connected with it, its circumscribed nature having been determined by a more complete closure of the vaginal peritoneal process, and by the limited space into which the effusion has taken place.

Under all these conditions, however, the pathology of the affection is the same, and the symptoms indicating its presence vary only according to the size and tension of the sac which contains the fluid. In the congenital form in which a communication exists with the peritoneal cavity, the hydrocele will never be found very tense—it will have a smooth and uniform outline, and will give all the symptoms of fluctuation; it will disappear also more or less readily by pressure, or by the patient assuming the recumbent position; the fluid then gravitating upwards into the abdominal cavity, with a rapidity which varies according to the size of the peritoneal communication.

In the diffused hydrocele of the cord this disappearance of the swelling by rest or pressure will not take place, for in such the opening of the vaginal process will have naturally closed.

FIG. 268.



The tumor will thus appear as a baggy or tense elastic swelling in the inguinal canal, which it will more or less fill. It will give to the hand a sensation of fluctuation, and in certain instances it may appear translucent; it will be found movable on any traction of the testicle, and will be accompanied with pain in proportion to the amount of tension of the cyst or of the inflammatory action.

In the more localized or apparently cystic hydrocele of the cord the same symptoms will present themselves. The tumor will be more isolated, probably

more movable and more tense, and it will be readily acted on also by any traction on the testis. It may occur as a single cyst or as many cysts, but each will present the same symptoms. When a single, tense, movable cyst exists it may be mistaken for a distinct morbid growth; but the diagnosis of the case ought not to be difficult when care is observed. Fig. 268 well illustrates the ordinary appearances of the affection.

Treatment of the Vaginal Hydrocele of the Testis.—In the *congenital hydrocele* so common in young life surgical treatment should be very simple, for the disease, as a rule, readily disappears with age and increasing strength;

a little cold lotion applied to the part, such as a solution of the hydrochlorate of ammonia, is frequently sufficient, and tonic medicine often aids the cure; for, as I have already stated, the effusion into the vaginal sac in those instances seems to be often of a passive nature, and its reabsorption may be expected with renewed powers. The hydrocele found in infancy, or *infantile hydrocele*, is not, however, always of the congenital form, for in these cases of infantile hydrocele there is no communication with the peritoneal abdominal cavity through the neck of the vaginal process. Under these circumstances a different treatment may be required to that which has just been recommended for the last. Cold lotions and tonics, however, in these may be of use, and should certainly be primarily employed, a good hope of success encouraging the surgeon in their use; yet in many instances the treatment will fail to cure the case, and some other more active practice will be demanded. *Acupuncture* may be then employed, and the fluid allowed to escape into the cellular tissue around the sac, when it may be altogether removed by absorption; but this treatment is not, as a rule, satisfactory, it being exceptional for a permanent recovery to be secured by such means, and I am disposed to think it better practice to draw off the fluid by means of a fine trocar and canula, and then to excite some fresh action in the membrane lining the tunica vaginalis by stirring it up with the end of the canula.

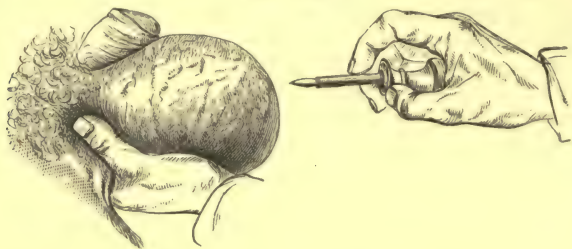
The treatment of vaginal hydrocele in the adult next claims our attention, and in modern practice it has become very simple.

In early examples, when the hydrocele is still small, and consequently of little inconvenience, it is as well, perhaps, to leave it alone, for, unless it causes anxiety to the patient, or proves troublesome or unsightly from its size, there is no necessity for interference. *In very old people*, again, it is as well not to interfere, unless a strong necessity exists, for sloughing of the scrotum, suppuration of the sac, and other bad results, occasionally occur in these cases from slight causes. It must be added, however, that the feelings of the patient are the best guide to interference, very slight enlargement causing in some patients as much pain as great enlargement does. Should, however, some treatment be demanded, as a primary measure simple tapping should be performed, the fluid being drawn off by means of a moderate-sized trocar and canula. In doing this some care is called for, although the operation is really a simple one, as difficulties are often made by the operator, and dangers result from want of caution.

On the Tapping of a Hydrocele.—As a point of primary importance, the true position of the testicle should be made out. In the majority of cases it will be found at the posterior part of the tumor, and unless this be very large, towards its lower part. At times, however, as has been said, it will be found in front from a congenital malposition, as well as in certain other cases which are difficult to explain. The true position of the gland can generally be made out by manipulation, and also by the want of translucency in the tumor at a certain spot. Having made out to a fair certainty the position of the testis, the tumor is to be taken in the left hand and grasped firmly at its neck, at the same time that care is taken to stretch the integument well over the cyst, and to render its wall tense and unyielding (Fig. 269). The trocar with well-fitting canula is then to be taken in the right hand (it having been previously well oiled), and the index finger placed about three-quarters of an inch from the extremity of the canula, the front of the thumb resting on its expanded end, the object of this position of the finger being to prevent the instrument going in too far with a rush, and thus endangering the testicle, and that of the thumb to press home the canula as the trocar is being withdrawn. The tumor is to be

punctured at its lower part—care being taken to avoid any large vein—and the fluid allowed to run out. Having completely emptied the cyst, the punctured integument should be firmly held, and nipped up with the thumb and finger of the left hand, and the canula withdrawn, a little cold air or the irritation of the finger generally causing sufficient contraction of the

FIG. 269.



dartos to close the wound and prevent hemorrhage or any further escape of the remaining fluid; a piece of lint may, however, be applied for purposes of cleanliness and to prevent friction.

In certain examples of this disease in the adult I have been induced to stir up the cyst as I have described in the hydrocele of the young, and have met with some success; in no instance has any evil consequence resulted from the practice, and in several a cure has taken place, evidently from inflammation. I would advise this practice to be confined, however, to young adults. As a palliative practice it is scarcely necessary to recommend any other than the one just described,—it is very simple, more efficacious than any other, and not more dangerous. Acupuncture has been advised, but it has no practical advantage over the simple tapping, and it is certainly less successful in its result. In exceptional cases it may be good, particularly in such a case as Mr. Curling has related on the authority of Mr. Luke, of a gentleman who was about to proceed to a part of the world where surgical advice could not be secured, and where the patient could then perform this simple operation on himself. I have known a patient, however, tap himself.

The period of relief which a patient experiences from a simple tapping varies exceedingly from a few weeks to many years; and even in the same patient the interval will be found to vary from time to time. In the young and middle-aged adult, when the general health is sound and a return of the effusion has taken place, unless any personal objection should be made, it is generally advisable to adopt some plan for a more permanent cure, and that leads me to consider what is generally described as the operation for the radical cure. In old men, however, it is the soundest practice to rest satisfied with the palliative treatment; only in exceptional cases should the radical cure be proposed.

On the Radical Cure of Hydrocele.—It is not necessary to review all the various plans which have been and are now employed for the permanent cure of a hydrocele of the tunica vaginalis; it will be more to the purpose to give the line of practice which is most successful and which at the same time is very simple, viz., the injection of the cyst with a solution of iodine. It is not perhaps a question of much importance whether the fluid should be concentrated or diluted, or whether it should be permanently left in the cyst or withdrawn after a few minutes have been allowed for it to act upon the secreting surface—such minor differences may be left to the fancy of

the operator. But my own judgment leans towards the practice of injecting a mixture of a drachm or more of the compound tincture of iodine with double the quantity of water, and allowing it to remain, care being taken that the canula is previously well pushed home into the cyst, and that no iodine solution is allowed to escape into the cellular tissue outside the sac. By this practice a radical cure is almost certain to be secured, and only exceptionally does any failure or any evil result follow; should the latter occur, it is generally due to the fact that a hydrocele has been injected when some inflammation of the testicle coexists, and from which it has been produced. In all examples of hydro-testitis the practice of injection must be looked upon as a bad one; it is treating the result of a disease, and not the disease itself—the effect, and not the cause. I do not propose to enlarge upon the other forms of treatment which have been employed, as incision, caustic, or even setons; for the practice I have advocated is so simple and successful as to surpass all others.

Treatment of Hydrocele of the Cord.—The principles of treatment which have been laid down in cases of hydrocele of the testis are likewise applicable to those of hydrocele of the cord, their application requiring only such modifications as may be demanded by the altered position of the affection. In the *congenital* hydrocele no special treatment is required, for, as strength comes to the child, the fluid will probably be reabsorbed, and failing this result, tonics should be given to expedite the cure, and some cold lotion applied, such as the chloride of ammonium with vinegar, ʒj to Oj.

In the *diffused or encysted* hydrocele of the child or adult more active treatment is frequently demanded, but not in all cases; for the fluid will at times disappear without treatment, although it may be only to recur at a later date; still the affection ceases to trouble, and, unless some real inconvenience is produced by its presence, it is as well to leave things alone. Should, however, pain or inconvenience be experienced, something must be done, and without doubt the best practice is to evacuate the fluid. In small, tense, encysted hydroceles the practice of evacuating the fluid by acupuncture is certainly a sound one; tapping by the trocar and canula is an operation of some difficulty where the cyst is small, and acupuncture answers in these small cases very well; it may be done with any needle, but probably those employed for cataract are the best, several openings being made. Should this fail and further measures be demanded, an incision into the cyst should be made, but this should not be carried out unless as a last resource. Tapping may be employed as in any other case of ordinary hydrocele. The radical cure by injection I have used on several occasions with success, and have not met with any bad results.

On Encysted Hydrocele of the Testis.—On examining the testes of the adult after death it is by no means an uncommon occurrence to meet with small cysts connected with the epididymis; they may be single or multiple, and, in many instances, are very numerous; they are generally more or less pedunculated, and, as a rule, connected with the upper portion of the epididymis, and are filled with a clear watery fluid, containing, in certain cases, some granules.

The pathology of the formation of these cysts is somewhat difficult to understand, and surgically it is of small importance, for they seldom, if ever become of sufficient size to cause inconvenience, or to require any surgical interference; indeed they are rarely diagnosed during life, and are discovered only on post-mortem dissection.

Another kind of cyst is, however, occasionally met with connected with the testis, and in close contact, if not associated, with the epididymis. It

springs from the same part as the smaller cyst, but grows to much larger dimensions, and generally contains a very different kind of fluid. Its origin is as obscure as the former kind; it enlarges very slowly, does not give rise to any pain, nor produce any inconvenience other than that caused by its size. It seldom requires treatment in its early stage, and, as a rule, many years are allowed to pass before interference is demanded, the tumors frequently developing for twenty years or more before advice is sought.

These cases are by no means so common as the ordinary vaginal hydrocele—not more than 5 per cent. being of this kind.

A cyst is occasionally developed between the tunica albuginea of the testis and the tunica vaginalis testis, the pathology of which is very obscure. Cases of this kind are described by Curling and Hutchinson. The Guy's Museum contains a specimen. I know of no means of diagnosing their existence. Their treatment would be similar to that of other cysts.

Symptoms and Diagnosis.—In an early stage of encysted hydrocele the diagnosis is not difficult, for the cyst usually appears as a kind of budding of the testis, or rather of the upper portion of the epididymis, as a tense, hard, globular, and in some cases, pendent tumor, more or less intimately connected with some portion of the spermatic duct. It is generally discovered by the patient by accident, and, when as large as the natural testicle, it has at times been set down as an extra organ.

The surgeon is not often, however, consulted in such a case in its early stage; as a rule, the tumor will have been allowed to grow to an inconvenient size before advice is sought. In forming a diagnosis, the history of the case will often at once throw some light upon its nature; the surgeon will, in all probability, discover that its increase has been extremely slow, twenty years or more often passing before the cyst attains anything like a large size. These encysted hydroceles probably never grow so fast nor acquire such dimensions as the more common vaginal kind.

The next feature demanding attention in the development of these cysts is the shape and outline of the growth, which is often rather striking; they never in their early stage, and rarely at any time, assume the appearance of ordinary vaginal hydrocele; but almost always maintain a globular outline.

The position of the testis in its relation to the cyst next claims attention, and in this a marked difference exists between the encysted and the vaginal hydrocele; in the latter, as a rule, it is to be found at the posterior part of the sac, and towards its lower part; in the former, or encysted, it is to be found almost constantly in front, or at one side, or below, being but rarely found at the posterior part. The reason for this is readily explained. The cyst is usually connected with the epididymis, which normally lies at the posterior part of the gland. The nature of the cystic contents differs also in many points from the fluid of a vaginal hydrocele and is very characteristic. In the *vaginal* hydrocele the fluid has been described as being generally clear, like the serum of the blood, more or less albuminous, of a straw color, and at times spontaneously coagulable, blood and cholesterin being also occasional elements. In the fluid of an *encysted* hydrocele none of these elements are generally present; it is, as a rule, a limpid, slightly saline liquid, more or less watery or opalescent, as if mixed with milk, always containing some granules in suspension, and frequently spermatozoa. The slowness of its growth, the globular outline, the anterior position of the testicle, and the nature of its cystic contents, are the four points in which the cystic hydrocele differs from the vaginal.

The origin of the spermatozoa in these cysts is a point of peculiar interest, for it has been a disputed point with pathologists for many years. Mr.

Curling's investigations on this subject have, however, proved that in some instances their presence is certainly due to the rupture of one of the spermatic tubes which pass over and are in close connection with the walls of the cyst—this rupture taking place generally from an injury, and being indicated by some rapid increase in the size of the cyst. Mr. Curling has shown that, in several of the cases in which spermatozoa were found, this history was given, and in some he was even able to demonstrate a distinct communication between the cyst and the spermatic tube. The following case tends to support his views. Robert P—, æt. 60, came under my care, at Guy's Hospital, on December 28th, 1863, with an encysted hydrocele of the left testicle of twenty years' growth. The increase had been very slow till the last month, when the tumor had doubled its normal size, this rapid growth having followed an injury produced by a fall. When first under my observation the scrotum contained an irregular cystic tumor on its left side, evidently made up of several cysts, of which three of large size could readily be distinguished, two being very tense, while the third was baggy. The testis was found on the inner side of the tumor. Tapping was at once resorted to, and the largest cyst emptied, many ounces of a milky fluid being drawn off. The second tense cyst was then tapped through the same opening, with the same result, and the fluid collected in a distinct glass. The third cyst was also tapped, but in this the fluid was quite watery. The first two contained abundance of spermatozoa, the third did not contain any. A good recovery took place.

The Treatment of Encysted Hydrocele.—However interesting may be the two forms of hydrocele which we have just been considering, both in their pathology and in their points of difference, the treatment in the two cases is practically alike. When anything is required to be done, simple tapping may suffice, and as a primary measure it should always be preferred; but, should the radical cure be required, the injection of iodine may be carried out. The slow growth of these cysts, however, and the equally slow re-collection of their contents after tapping, are points which indicate the propriety of adopting the palliative treatment in the majority of cases.

On the Spontaneous Disappearance of a Vaginal Hydrocele, with a Case.—It is well known that in children hydroceles, as a rule, disappear spontaneously with little or no treatment, but in adults such a result is most uncommon. Mr. Pott, Sir B. Brodie, and Curling relate cases of this kind, and attempt to explain the process by which such a recovery takes place with more or less success. A single instance of the kind has passed under my hands for treatment.

Charles C—, æt. 64, came to me at Guy's Hospital on Jan. 29th, 1863, with a hydrocele of the left testis, the size of a cocoanut. He had had it two years, and had been tapped six times, having been under my care on each occasion. He came under my notice at this date, when I was about leaving the hospital, and I did no more than examine the parts, which were tense and rather painful, telling the patient to return to me, in the course of a few days, to be relieved. When he came the following week all indication of swelling had completely disappeared, the man assuring me that he had gone to bed the night of the second day before his visit with a large tumor, and that when he awoke it had disappeared. He added also that he had on the following morning passed a large quantity of thin urine. The patient was a steady man and a widower, and told his tale with all the appearance of truth and with some astonishment. In three months the fluid had re-collected, when he was tapped. I will not attempt an explanation of this case.

On Hæmatocele.—As the term hydrocele is applied to the effusion of serous fluid into the sac of the tunica vaginalis, and of its tubular prolongation upwards to the internal ring, as well as into the cysts which have been already described as being connected with the testis, so the term hæmatocele is employed to designate an effusion of blood into the same regions. We thus have—

A vaginal and an encysted hæmatocele of the testis.

A diffused and an encysted hæmatocele of the cord.

Hæmatocele may occur in an organ which had not previously shown any symptom of disease, or it may be associated with a hydrocele. It may appear spontaneously without an injury, or as the result of a blow, strain, or the tapping of a hydrocele. It may attack patients at any period of life, and in certain rare cases at a very early age, even in infancy, and I have the records of a case in which it was said to have made its appearance at two years of age.

In the notes of my cases various causes have been assigned for its production. In one instance "it appeared gradually without any known cause." In another "it occurred when hard at work pushing a wheelbarrow, something giving way with a snap." In the majority it came on as an immediate consequence of a blow, and in several as the result of the tapping of a hydrocele. In all, however, the result was the same,—a more or less rapid formation of a tumor in the position or neighborhood of the testicle.

Symptoms and Diagnosis.—The symptoms of a hæmatocele which has made its appearance without any injury or assigned cause are very obscure, and are pretty well summed up in the prominent one of a gradual and uniform enlargement of the organ. The swelling will vary in shape as in a hydrocele, but, like it also, it may present a more or less pyriform outline. The testicle will always, in the vaginal hæmatocele (on careful manipulation being made), be detected somewhere in the sac, and usually at its posterior and lower part, the peculiar testicular sensation being produced by slight pressure.

When caused by a sudden strain or injury the enlargement will be more sudden and rapid, it will be found to follow close upon the receipt of the accident, and the rupture of the bloodvessel may even be announced by the sensation of a sudden snap or giving way.

The local symptoms will be similar to those already described.

The tumor, at its first appearance, may be somewhat soft and obscure, or clear fluctuation may be detected in it; but if much time be allowed to pass before coming under observation, this fluctuation will not, in all probability, be made out, for the effused blood rapidly coagulates, and gives rise to the sensation of a solid growth. The sac of the hæmatocele, whether tunica vaginalis or cyst, rapidly alters in character and becomes thick, and in certain cases, fibrous or even cartilaginous; at first from the coagulation of the fibrin of the blood upon its inner surface, and in cases of longer standing from distinct inflammatory changes, brought about by the presence of the blood acting as foreign matter. In some instances this thickening of the cyst is very great, even to half an inch.

When a hæmatocele has followed upon a hydrocele, there will usually be a sudden enlargement of the part after the strain or injury, accompanied with more or less pain, this pain apparently depending upon the amount of distension to which the cyst has been subjected. Should it follow the operation of tapping, it will, as a rule, be recognized by the escape of more or less blood or bloody fluid at the time of operation; and the rapid refilling of the hydrocele sac or cyst with a more solid and opaque material.

To form a correct diagnosis of hæmatocele the history of the case is most important, indeed, more so than the local symptoms, for it is certainly true that by the latter alone, in some instances, it is almost impossible to make out the true nature of the affection.

By way of summary it may be stated that a hæmatocele is usually a uniformly smooth, tense, and *non-transparent* tumor, with an *indistinct* sensation of fluctuation, but with *distinct* evidence of testicular pain on pressure. It may be accompanied with pain during the early period of the affection, from the distension of the cyst, but not at a later date, or during its chronic stage, unless softening down. As time passes it will become harder, should no symptoms of inflammation show themselves; but on their manifestation, evidence of suppuration will soon appear, for hæmatoceles have not, as a rule, a disposition to remain quiet like the hydroceles, but tend to open outwards by the breaking up of the coagulated blood which has been effused, and by the inflammatory process.

The symptoms which indicate the presence of a *hæmatocele of the spermatic cord* are somewhat similar to those already described for vaginal hæmatocele, the difference in locality being remembered; it is generally produced by a blow or strain, as in the ordinary vaginal hæmatocele. It is to be diagnosed by the suddenness of its appearance, or the suddenness of the enlarged hydrocele sac—by the opacity of the swelling, and tendency to consolidation which it possesses, also by the accompanying ecchymosis of the parts. Cases are recorded by Bowman, Curling, and others, in which this disease obtained enormous dimensions, but such examples are very rare, indeed, the affection is by no means common.

On the Source of the Blood.—A very common question with students is, as to the origin of the blood in these cases of hæmatocele, and in the spontaneous cases, and those following a strain or injury with an apparently sound testis, this question is difficult to answer. There can be little doubt, however, that a distinct rupture of some of the vessels, probably veins, which ramify upon the body of the testis, or on the tunica vaginalis, must take place.

When occurring upon a hydrocele, or after the operation of tapping, it is probably due to the distinct rupture or perforation of one of the large veins which ramify outside the tunica vaginalis, into its interior, or of one in the body of the testis.

Scarpa relates a case of hæmatocele in which the spermatic artery was wounded, and Sir A. Cooper another in which a distinct rent in the tunica vaginalis was found on dissection. This latter condition is probably the most common.

TREATMENT.—The treatment of hemorrhage into the tunica vaginalis testis, or cord, differs in no respect from the treatment of hemorrhage into any other part of the body. In the very earliest period of its occurrence, rest in the horizontal posture, with the testicles well raised, and the application of ice or cold lotion, are the most efficient means to arrest the flow of blood and to relieve pain. By such means the blood may also be reabsorbed and all future mischief be prevented. Should the blood, however, remain fluid for a long time and no symptoms of reabsorption or of inflammatory action manifest themselves, it is probably a sound practice to draw off the fluid contents with a trocar and canula. I have had a case in which this practice was adopted with good effect.

Should signs of inflammation appear soon after its occurrence, cold lotion and leeches, with the aid of saline purgatives, may occasionally be found efficient to arrest its progress, and to allow of the subsequent reabsorption of the effused blood. But should symptoms of suppuration show them-

selves, or of the softening down of the coagula, a free incision into the cyst or tunica vaginalis is the only sound practice, the whole semi-solid contents being thoroughly turned out, and the interior of the sac allowed to granulate. In old and chronic cases, with thickened sac walls, the same treatment is also effectual. I possess the records of many cases in which this practice was carried out with marked benefit: in one case of only four months' duration, and in another of twenty-nine years, in which the tunica vaginalis was at least half an inch thick, and in both a good recovery followed as the result. I need hardly add that excision is rarely called for in the treatment of these cases, although from difficulties in the diagnosis it may occasionally have been had recourse to; I have seen several such instances, but beyond the loss of the organ no evil resulted. In old cases of hæmatocele, in aged subjects, the practice of excision is probably the best; but in the young, and middle-aged, it cannot be advised. The treatment of hæmatocele of the cord is to be conducted on similar principles.

CHAPTER LVIII.

ON DISEASES OF THE TESTICLE.

On Inflammation of the Testicle.—Under the term *Orchitis*, most authors have been in the habit of including the inflammation of two distinct portions of the testicle, and of mixing up the symptoms of the two affections to the prevention of a sound and clear understanding of this subject. In the present chapter I shall attempt, as far as I can, to separate the two, and to describe inflammation of the epididymis as one affection, and inflammation of the true secreting gland as another, calling the former *epididymitis*, and the latter *orchitis*. In certain cases, it is true, both structures are involved in the inflammatory action, and to this state I shall apply the term *testitis*; the three words accurately indicating the true seat of the malady, and consequently tending to facilitate its better study.

All surgeons will be ready to admit the distinctness of these two parts, anatomically and physiologically, and it is as well also to acknowledge that pathologically they are constantly divided, for of this I am certain, that to the student of the affections of this organ, this division tends to clearness, and to a more ready appreciation of its several diseases.

As a preliminary to the more special clinical and pathological consideration of these diseases, the following observations of Sir J. Paget, as given by Curling, upon the development of the epididymis and testis, may be read with interest and advantage.

Sir J. Paget observes "that, in the normal course of human development, the proper genital organs are in either sex developed in two distinct pieces, namely, the part for the formation of the generative substance, the testicle or ovary, and the part for the conveyance of that substance out of the body, the seminal duct or oviduct. The testicle, or ovary, as the case may be (and in their earliest periods they cannot be distinguished) is formed on the inner concave side of the corpus Wolffianum, and the seminal duct or oviduct, which is originally an isolated tube, closed at both extremities, passes along the outer border of that body from the level of the formative organ above, to the cloaca or common sinus of the urinary, genital, and digestive systems below. The perfection of development is

attained only by the conducting tube acquiring its just connections at once with the formative organ, and through the medium of the cloaca with the exterior of the body. The sexual character is first established when, in the male, the formative and conducting organs become connected by the development of intermediate tubes which constitute the epididymis; or when, in the female, a simple aperture is formed at the upper extremities of the conducting tube, and is placed closely adjacent to the formative organ. In both sexes alike, the lower extremities of the conducting tubes first open into the common cloaca, and subsequently, when that cavity is partitioned into bladder and rectum, or bladder, vagina, and rectum, they acquire in each their just connections, and become, in the male, the perfect vasa deferentia, and in the female, Fallopian tubes and uterus."

I will remind the student that the epididymis naturally forms the posterior part of the testicle, and the secreting portion, or true gland, the anterior; that the former in a perfectly healthy state is only indistinctly felt, the vas deferens on being traced downwards from the cord losing itself as it were in this part. The body of the gland is always to be made out by its smooth and elastic globular form.

On Epididymitis, or Inflammation of the Seminal Duct.—Inflammation of the epididymis is almost always a consecutive affection, and occurs in association with gonorrhœa, or as the result of some other irritation of the prostatic urethra, such as the presence of a calculus, or the passage of a sound or lithotrite. It generally comes on suddenly, and is accompanied with considerable pain, and a marked enlargement of the epididymis, or posterior part of the testicle, forms its chief local symptom. It is constantly preceded by severe pain in the anal and iliac fossæ, and is usually attended with œdema and redness of the scrotum over the inflamed tube. It is a very painful affection, and is accompanied with special tenderness of the part, this tenderness being readily traceable up the cord, which is occasionally swollen and œdematous. The inflammation is a direct extension from the urethra down the vas deferens to the epididymis—in fact, is an inflammation of the true seminal *duct*, and not of the seminal *gland*.

This enlargement of the epididymis is very rapid, and in some instances very great. It invariably assumes a special outline when uncomplicated, that is, when confined to this special part, the epididymis appearing of a boat or truncated half moon-shape, holding the body of the testicle in its concavity. The lower portion of this body is usually the most enlarged, being composed of the greater number of the convolutions of the tubes, and consequently containing more cellular tissue, for it is from the infiltration with inflammatory effusion of this cellular tissue around the inflamed seminal duct that this enlargement is produced.

The affection generally is an acute one; it comes on suddenly, and runs a rapid course, and is accompanied in most patients with some constitutional disturbance. In some subjects this is very severe, in others, it is of a milder description, the sharpness of the inflammation and the peculiarity of the patients influencing the severity. It is characterized by the special symptoms already indicated, and its diagnosis is not, consequently, difficult.

It is at times, however, complicated with other conditions, such as an inflammation of the true secreting portion of the testicle, but this complication invariably occurs as a secondary symptom, and is produced by direct extension of the disease from the seminal duct to the gland. I have never seen a genuine orchitis, or inflammation of the seminal gland, as a result of gonorrhœa, except as an extension of the inflammation from the

epididymis, and it is in quite exceptional examples of this affection that the body of the testicle is ever involved.

When the gland itself is inflamed, the diagnosis is readily made, the enlargement and great tenderness of the part clearly indicating what is the matter. The whole organ presents an expanded but flattened aspect, the swelling of the epididymis posteriorly, and of the body of the testis anteriorly producing this peculiar laterally flattened outline. The two inflamed parts will, however, be always felt distinct from each other, and can be readily diagnosed. There is, however, a second complication of epididymitis, which is more common than the one just described, and that is, the effusion of fluid into the tunica vaginalis, the production of an acute hydrocele, and I am disposed to think that it is this apparent swelling of the organ which has given rise to the mistaken idea that true testitis is a common affection after gonorrhœa. The enlargement of the organ from such a condition is, however, very different from the enlargement already described as due to an inflamed gland; it is more globular, tense, and elastic; it is certainly equally painful with that affection, but its true nature can be readily made out by its translucency, and by the presence of fluctuation on palpation. It is the result of a direct extension of the inflammation from the epididymis to the tunica vaginalis, and the following explanation of its occurrence by Gendrin, as given by Curling, who assents to its soundness, seems most satisfactory, for it is certainly borne out by clinical observation. He says, "When the subserous cellular tissue, which always participates in the inflammation of a serous membrane, penetrates into the interior of an organ, it becomes a ready means of communicating the inflammatory action, but when the contiguous organ in subjacent parts is of a different structure from that of the cellular tissue, the extension of inflammation inwards is checked. Thus, in the case of the inflamed tunica vaginalis, the cellular tissue readily transmitted the morbid action to the epididymis, but the tunica albuginea arrested its progress to the body of the testicle, and this explains the fact, that after inflammation of the tunica vaginalis, excited by injection, the body of the gland is rarely found to suffer. On the other hand, the epididymis is seldom attacked with inflammation without the disease being quickly propagated to the tunica vaginalis."

As the disease subsides in the epididymis the hydrocele, as a rule, disappears, it being exceptional for the latter condition to remain when its cause has been removed. As a consequence of this epididymitis, it is by no means uncommon for a considerable thickening of the seminal ducts and of their surrounding cellular tissue to remain for many weeks or even months. In the majority of cases, however, this result does not take place, for in the healthy subject there is every reason to believe that with the inflammation all effusion disappears, and the organ is left as sound as it was before. In the cachectic patient this happy event does not, however, always take place, and more or less thickening of the inflamed part will generally be observed, the epididymis feeling indurated and enlarged, and in parts nodulated and cordy. It has been a disputed point by pathologists whether this condition ever leads to an atrophy or destruction of the testicles, or whether it has any influence upon the true function of the organ in causing sterility, and upon this point I have no positive facts to bring forward, but I have certainly seen a wasting of the glandular structure of the testicles after inflammation, the result of an epididymitis. In one instance I witnessed inflammation of the body of the testis in a young man who married at a time when he had a marked induration of the epididymis, the result

of an attack of inflammation some months previously; and I entirely attributed the inflammation in his case to the retention of seminal secretion from the obstruction to the seminal duct, the result of the old epididymitis.

We know, also, that all ducts or canals are liable to obstruction or to stricture when surrounded by organized inflammatory products; and it is only right to believe that the spermatic ducts are obedient to the same law which governs others. This result may not, however, be very common, although it may certainly occur.

One word as to the side on which this epididymitis most frequently takes place, it having been generally asserted, on the dictum of Sir A. Cooper, that the left side is the one more often attacked. Mr. Curling, in his admirable treatise on the testes, tabulated the collected experience of many surgeons, and showed that in 138 cases of so-called consecutive orchitis, the right testis was the seat of the disease in 78 examples, the left in 49, and both glands in 11. My own figures bear out the truth of these conclusions, for of 73 examples of epididymitis 35 were of the right organ, 25 of the left, 4 were double, and in 9 the fact was not stated.

The right organ is, therefore, more often affected than the left, but the reverse obtains in hydrocele, in which the *left* side is the most frequent seat of disease.

I took some pains, during the eight years I registered the cases of gonorrhœa and diseases of the testes, to find out whether the general opinion was correct, that the epididymitis usually appeared on the disappearance of the urethral discharge, and whether it was relieved on its reappearance—whether it could be traced to any peculiarity in the treatment of the gonorrhœa, or to any neglect, or other cause; and I must confess that I have not been able to connect these phenomena in any way. It appeared to me that the epididymitis made its appearance during all stages of the complaint, and under every kind of condition, when injections were employed, and when they were not, when copaiba and cubebs had been taken, and when they had not. That in some cases the diminution of the discharge and appearance of the epididymitis were coincident is quite true, but such a result is only consistent with the general rule, that an inflammation set up in one part tends to relieve an inflammation existing in another, and more particularly in a neighboring tissue. It appeared in the majority of cases of neglected gonorrhœa, and in others in which strong injections had been recklessly employed, but more particularly in the cachectic and irregularly-living patients, who had been utterly regardless of their affection, and had taken no means to keep the testes well suspended.

Treatment of Epididymitis.—The treatment of this affection must depend upon the intensity of the inflammation, and the severity of the local and constitutional symptoms which it produces. Rest in the horizontal posture, with elevation of the testes or even of the pelvis, active purgatives, with saline medicines, combined in acute cases with tartar emetic, colchicum wine, and hot poppy fomentations to the part, are often sufficient to check the disease at its onset, and to prevent its passing into a chronic stage. A good opiate at night is also a wise measure to adopt. When the local symptoms, with pain, are very severe, leeches may be applied to the neck of the tumor as the best place, or one of the turgid veins in the scrotum may be opened. The use of mercury in these cases, except as a purge, does not appear to be of much value, although it has the support of many experienced and trustworthy surgeons; personally I object to its use, as being unnecessary in the acute affection.

Should our patient, from social reasons, object, or be unable to keep at

rest, the parts must be well supported by a suspensory bandage, or by a handkerchief folded crossways in a triangle, the apex of which is well braced up posteriorly by a piece of tape, or bandage, and the base attached firmly to a band brought round the waist, and the same treatment pursued as we have already indicated.

FIG. 270.



As a local application in the earliest stage of the disease, ice is of great value.

The treatment by compression has also its advocates, who speak strongly of its advantages. In former times it was carried out by means of strapping; at the present day it is most efficiently performed by means of an india-rubber bag. Messrs. Hutchinson and Lee have been its chief advocates. It may certainly be practiced in some cases, but it

must be well applied, and at the best it excites at first severe pain, which, however, soon disappears. I have used it but little in the acute affection, but in the more chronic or subacute stage of the disease, treatment by pressure is of great value. Vidal's plan of puncturing the tunica vaginalis, or even the testis itself, has been freely practiced by some English surgeons. Messrs. H. Smith and Hutchinson advocate the practice, and speak highly of its value. I give it on their authority. I have never seen a case calling for so severe a measure. An incision into the tunica vaginalis may be made with impunity when tension exists, but I should hesitate to puncture the testicle unless suppuration be present.

In chronic epididymitis, when the disease has passed into an inactive stage, and little but the *product* of the inflammatory process remains behind, the treatment by pressure appears very valuable, indeed more so than any with which I am acquainted, for nothing tends more to hasten the absorption of the inflammatory product. (Fig. 274.)

If mercury is ever needed in this affection, it is at this stage, for its power, doubtless, lies in its tendency to produce disintegration of tissue, and more particularly of inflammatory products, the organization and subsequent contraction of which in and around the spermatic ducts produces the special evil effects of epididymitis. When I have had occasion to use it, I have done so as an ointment applied to the part, with pressure, and have had good results from such a practice, but how far my success has been due to the pressure alone I am unable to say. Of late I have been accustomed to employ simple pressure in these cases, and have no reason to believe my success has been less favorable than it had been previously. Tonics have been administered freely in all these cases.

Should suppuration take place as a consequence of epididymitis, a result which occasionally happens, it is well to open the abscess early, and that pretty freely, for by such a practice the discharge finds easy vent, and a good recovery is more likely to occur, while the formation of sinuses is prevented. Water-dressing to the part, and the use of the suspensory bandage, are the best local means, but tonics and good living are also generally required.

On Acute Orchitis, or Inflammation of the Seminal Gland.—Orchitis or inflammation of the seminal gland for the most part occurs as an *acute* affection, as the result of an injury, but it appears at times spontaneously without any such cause, and more particularly in connection with parotiditis, or mumps. As already stated, it may be due to an extension of inflammation from the epididymis or spermatic duct, but it rarely, if ever, takes place as a primary affection in connection with gonorrhœa.

Acute orchitis may also attack the gland in its descent into the scrotum. The following case illustrates this fact: Robert H—, æt. 12, was brought to me at Guy's Hospital on June 20th, 1859, under the following circumstances: The *right* testicle was not to be felt, having evidently not descended from the abdomen. The *left* had put in its first appearance at the external ring three days before his application to me, the boy having experienced pain in the groin, extending upwards towards the loin for two weeks previously. On walking into the room, it was at once observed that his body was bent unusually forwards, and that his movement was much restrained. On examination the testicle was readily felt in the left groin, having passed down the canal, and partially through the external ring. The gland was of a large size, about the size of an egg, and remarkably tender. The horizontal posture was ordered to be maintained, with the thigh flexed, and cold lotion or ice applied. In three days the symptoms had somewhat abated, and at the end of the week the swelling was much less. On July 11th, or the twenty-first day after coming under observation, the testicle had passed the external ring, although resting close to it in the scrotum. In another week all pain had subsided; the testis was free, and the patient disappeared from observation, being quite well.

On August 16th, 1871, I saw with Mr. Forman, of Stoke Newington, a case of acute inflammation of the left testis which was at the internal ring, in a boy, æt. 14. It was accompanied with severe local and abdominal pain, constipation, and vomiting, leading Mr. Forman to suspect the presence of a hernia. When I saw him with these symptoms and an inflamed painful inguinal swelling the size of an egg, I explored the part, and found the tunica vaginalis filled with pus and a small undeveloped testis. All the symptoms speedily subsided after the operation, and a good recovery ensued.

As a *chronic* affection, it is the most common form of disease of the testes which is met with in practice, and as such it may take place as the secondary result of the acute disease, or as a consequence of some constitutional affection, such as gout, but more particularly of syphilis.

The symptoms of acute orchitis are very marked, and its diagnosis is easy, for the rapid enlargement of the body of the gland, its flattened oval form, and extreme tenderness, are very characteristic. The patient will complain of its weight, and if standing, he will probably assume the bent posture. The disease will be accompanied by extreme local tenderness of a dull, aching character, and pain which passes up the loins, round the hips, and often down the thighs. The scrotum will probably manifest some symptoms of inflammation, such as swelling, redness, heat, and increased vascularity.

The constitutional symptoms will vary according to the susceptibility of the subject of the disease, in some cases being very severe, in others less so. They will be those of general irritative fever.

In exceptional examples of this acute affection there will be some effusion of fluid into the tunica vaginalis, but this complication is not so common after acute orchitis as after epididymitis, for reasons which have been already given.

As a rule, it may also be asserted that acute orchitis tends towards recovery, and seldom terminates in suppuration, unless it be of the tubercular form, or affecting very cachectic patients. In one known example it ended in gangrene of the part; this case was recorded by the late Mr. Harvey Ludlow, in his unpublished Jacksonian prize essay. The case was under the care of Mr. Stanley, who was induced to cut into the gland, from the severity and obstinate character of the pain, and a black gangrenous cavity was exposed, which was seen after death to have occupied half the organ. I have

the records of a case in which the patient stated that one testicle sloughed out after inflammation six months previously: the man came under treatment for inflammation of the other. The termination by suppuration, however, occasionally takes place, and numerous are the examples of this condition which I possess. These cases also may at times end favorably, the abscess healing without any evil result, but too frequently the discharge of the abscess ends in what has been variously described as benign fungus of the testis, or granular swelling, or hernia testis. The latter is the most correct and intelligible name, the affection being the result of rupture or ulceration of the tunica albuginea, and the gradual extrusion or hernia of the tubuli of the gland, the extruded gland being covered with granulations. The true nature of this affection was first described by Sir W. Lawrence in 1808, "Edinburgh Med. and Surg. Journal," vol. iv, p. 257.

Acute Orchitis as a consequence of Parotiditis or Mumps is a well-recognized affection, although it may be difficult to explain the connection between the two diseases; it is described by some surgeons as a kind of metastasis, but there are no published facts tending to support this view; no one, however, is disposed to deny that the one affection occurs in connection with the other. The disease is not usually very severe, and it commonly passes away with little treatment, leaving the testicle generally sound, few cases being recorded of atrophy of the glands attributable to this disease. The symptoms are precisely similar to those already described, and need no further illustration.

Treatment of Acute Orchitis.—The ordinary principles of treatment which are applicable to local inflammation in general are to be acted on in the treatment of this affection. Rest in the horizontal posture, with elevation of the parts and warm fomentations, are essential points for observation; leeching the groin or local venesection and saline purgatives with sedatives are the chief remedies. The disease has a tendency to get well by itself, and unless badly treated, or neglected, or attacking very cachectic subjects, this result will generally be attained. In extremely severe examples, where the inflammation runs high, tartar emetic in full doses is a most valuable drug; and colchicum in half drachm doses of the wine, with saline purgatives, often acts like a charm. Opium in full doses may also be given where pain is severe, and constitutional disturbance great. An acute attack, however, generally runs its course in about ten days, and seldom ends otherwise than well. At other times the local application of ice is most beneficial.

On Chronic Orchitis.—Of the true diseases of the seminal gland chronic inflammation is the most common, and is sometimes a consequence of the acute affection, often the result of an injury, but most frequently it is induced by some special constitutional condition, such as gout, tuberculosis, and more particularly syphilis.

The symptoms of chronic orchitis, when depending on the majority of these causes, are much alike; they differ only in some minor, although important points. In the inflammation due to the syphilitic virus the symptoms are somewhat peculiar, and, as the diagnosis of the affection is important, it will receive at our hands a special consideration. The subject will consequently be divided for consideration into the ordinary forms of chronic orchitis and syphilitic orchitis.

Symptoms and Diagnosis of Chronic Orchitis.—The most special point in the natural history of chronic orchitis is its insidiousness; it comes on, unless following an acute attack, so unmarked by any special symptoms, and unaccompanied by any pain, that in certain examples it is only by the increased size of the gland that the patient is induced to seek advice.

In other cases, however, this swelling is accompanied by pain of a dull and aching character. In the early stage of the disease the gland may be more or less painful on manipulation, but in a more advanced condition, or in a very chronic case, no local pain will be experienced, even on somewhat rough manipulation, and in these examples even the ordinary testicular sensation will fail to be excited on firm pressure. The general appearance, also, of the testicle, the subject of this affection, is somewhat peculiar; it is not pyriform or globular, as in hydrocele and many other affections of the gland, but it has a peculiar flattened outline from side to side, and a smooth even surface—unless the disease be associated with some effusion into the tunica vaginalis, when the tumor will naturally assume more the shape of a vaginal hydrocele. But the simple affection is rarely associated with such a complication, and when it is, the fluid is, as a rule, secreted in very small quantities. The epididymis, in exceptional examples, may be slightly enlarged and thickened, from the extension of the inflammation to its tissue; but when this does take place it will rarely be to any great extent.

There are seldom, also, any constitutional symptoms worthy of remark, except in cachectic and irritable patients, when the dull aching pain of the part will generally give rise to some general irritability of the patient's condition, and an anxious expression of countenance.

The pathology of this affection is not difficult to understand, for it is precisely similar to that of any chronic inflammation of any other part. It consists of a more or less general infiltration of the gland with an organizable or organized material, which separates the secreting tubuli and acts on them in different ways, according to the amount of fibrin poured out between them and the amount of pressure to which they are subjected. In some cases the inflammatory product is diffused very generally between the tubuli, in others it is deposited in irregular masses; but when the material poured out is very great, and is equally diffused between the meshes of the testis—that is, when the disease is extensive or of long standing—that condition of gland is probably produced which is indicated by an utter absence of the natural sensation of the organ on handling or on firm pressure; and in this stage, short of the breaking up of tissue, there is the greatest anxiety for the subsequent maintenance of the integrity of the organ. Should the disease make a favorable progress towards recovery, and this inflammatory product be reabsorbed, the pressure will be proportionately removed from the delicate tubuli of the organ, and with this condition the natural testicular sensation will be restored—a point which should always be looked for in the treatment of these cases, and one of great value as indicative of recovery.

Should the inflammatory product soften down, as it will in the delicate and cachectic subject, suppuration will take place, and in proportion to its extent will the liability to a *hernia testis* be manifested.

And again, should this inflammatory product proceed to a more permanent organization, and contract, the delicate tubuli of the testicle will necessarily suffer in proportion to the extent of the part involved, and an atrophy of the organ will, as a consequence, be the result.

All these results are met with in practice in various degrees, and in greater or less frequency, the general condition of the patient having a more important influence in determining the result even than the treatment; but I may add that there are few affections which are more amenable to good treatment than the one now under consideration.

When the disease is remarkably insidious in its advance, slow in its progress, and painless in its character; when the patient is cachectic and

irritable, with an anxious countenance, a disposition to a hot skin, and other symptoms of constitutional irritation; and, more particularly, when the disease ends in suppuration, as it in all probability will when coming on and progressing in the manner just indicated, it is reasonable to believe that the organ has been the subject of *tubercular mischief*, disorganization of the testis taking place as a result. It must be added that in these cases the tubercular affection is probably of the infiltrating or miliary tubercular form, and not of that crude nature which runs a different course, and to which attention will subsequently be directed.

In gouty inflammation of the organ the symptoms are not, as a rule, so chronic as they are in the class of cases to which we have just alluded. Indeed, they may more rationally be described as being of a subacute nature, for, although generally coming on slowly, they are manifested by greater local tenderness and pain; the pain will also at certain periods be considerably aggravated, and most probably this will be the case at night. The disease has also a strong tendency towards recovery, and not towards disorganization. Besides these symptoms, others indicating a gouty disposition will probably be present, as acidity of stomach, a loaded condition of the urine, and a more or less distinct history of gout. There will also be frequent nocturnal pains in the opposite testicle, of a darting character, leading the patient to fear a double attack, and when these pains occur they are valuable as diagnostic symptoms, in connection with others.

Symptoms and Diagnosis of Syphilitic Orchitis.—That syphilitic inflammatory disease attacks the testicle as it may any other gland or texture of the body, whether within or without, seems a tolerably well-recognized pathological fact at the present day, and to my colleague, Dr. Wilks, is due the credit of bringing this subject clearly before the profession. It remains for us now to compare our clinical observation with pathological knowledge, and to point out such symptoms as may aid in the recognition of syphilitic inflammation as affecting the seminal gland tissue.

But before doing so it may be well briefly to consider in what way the syphilitic differs from other forms of inflammation; this will tend to help us in the special application of the subject to the local affection, and, fortunately, for the sake of brevity, the points of difference are neither numerous nor deeply seated. The main one to which I shall allude is palpable and apparent, even to the most casual observer, for it is readily seen that in all syphilitic inflammations there is a marked tendency to the deposition of a product which rapidly undergoes fibrous changes, and tends to infiltrate the part affected with an organizable or organized material of a dense, firm, and fibrous structure. We see this in every tissue, and in every stage of the disease. We see it manifesting itself primarily in the true infecting chancre by the almost cartilaginous hardness of its base; we see it in the early constitutional symptoms of syphilis, in the different eruptions, and in the greater permanency of their skin staining; in the different affections of the mucous membranes in all their parts; in the inflammation of the eye, cellular tissue, periosteum, and bone. The pathologist sees it in the many changes found after death in the internal organs of the syphilitic subject; and the surgeon sees it, likewise, in the inflammation of the testes. For we find that in the syphilitic patient the testicle may at some period of the disease, and generally at a late one, become the seat of a syphilitic inflammation, which manifests all the peculiarities of this pathological condition. The affection is essentially a chronic one, as much so as the other forms of chronic orchitis, but it is almost invariably confined to the body of the gland, and but rarely affects the spermatic duct. It is quite painless in its nature, locally and generally, the patient bearing free manipulation without

flinching, and often thinking little about his disease, except from the increased size of the organ. The special sensation of the gland usually disappears at a very early stage of the disease, and there is rarely any constitutional disturbance accompanying its progress. It may or may not be associated with other symptoms of constitutional syphilis, but it usually appears alone.

The disease manifests itself locally in a special manner which claims attention. It usually affects the body of the testis and both testes at different periods of its progress—rarely, however, both at the same time. It is almost always complicated by the presence of a vaginal hydrocele, and this at times increases to a considerable size—much more so than in other forms of chronic orchitis. But the most characteristic point of all is the remarkably stony induration of the part, and the peculiar irregularity of the outline of the gland, the surface of the swelling being very nodular; in some cases small fibrous projections from the body of the gland are distinctly visible; and in some, loose bodies are felt in the tunica vaginalis.

The diagnosis of this disease is consequently not difficult, for the symptoms are somewhat peculiar. In the majority of cases it terminates by resolution, and apparently leaves the gland intact; but in many a gradual wasting of the testicle is the result, which terminates in atrophy, and, as a consequence, in sterility. In exceptional cases suppuration may take place with or without hernia testis. The disease, when apparently cured, has a remarkable disposition to return on the slightest provocation.

The Treatment of Chronic Orchitis.—There are few affections more amenable to treatment than chronic orchitis, particularly when taken early; and there are none which better prove the value of pressure and mercurials in procuring the absorption and disintegration of inflammatory products. In the common orchitis as well as in the syphilitic this opinion holds good; but, in the gouty, the treatment must be modified according to the special peculiarity of the patient. In a healthy subject, with good powers and an unbroken constitution, any form of mercurial may be administered, such as blue pill in four-grain doses, or mercurial inunction, or the perchloride of mercury; but as the object of the surgeon is not to salivate, nor to bring the patient rapidly under the influence of the remedy, but rather to procure a lengthened and equal action of the drug upon the local disease, the dose should be carefully regulated. In my hands the iodide of mercury given in one-grain doses, with five grains of Dover's powder, twice a day, or the mercurial suppository, has proved eminently beneficial, the testicle being well strapped up by common soap plaster. (See Fig. 274.) In a more cachectic patient, in whom mercury may still be tolerated, the same treatment may be employed, although in smaller doses; and in others the mercurial may be locally applied in the form of an ointment, with strapping over it. During this time tonics, as quinine and iron, may be administered, and good living and fresh air enjoined.

In certain examples, however, occurring in cachectic patients, it may not seem desirable to administer mercurials in any shape, and under such circumstances iodine may be substituted in the form of the iodide of potassium, in three or four grain doses, combined with half-drachm doses of the syrup of the iodide of iron in infusion of quassia, three times a day. Locally, strapping, or rather pressure, should still be enforced. In hospital practice this treatment has been of great value; by it, steadily persevered in for six or eight weeks, even the worst of cases may be expected to yield, the organ gradually becoming softer and more natural in sensation and shape, and at last resuming its normal condition.

In the gouty form of orchitis, which is to be recognized or suspected by the symptoms already quoted, the administration of colchicum is very beneficial. It is to be given in small doses, and continued for several weeks. The acetic extract in half-grain doses, with Dover's powder, is the best form, and with it a cure may generally be guaranteed. This form of disease is tolerably easily reduced when early recognized. It is more liable, however, to relapses; but less so than other forms to disorganization and subsequent atrophy.

Should there be sudden accessions of pain in the part, with other evidences of some fresh inflammatory attack, the application of a few leeches with hot fomentations is very serviceable, but these conditions are not common.

When vaginal hydrocele coexists with the inflamed gland—a frequent complication of the syphilitic variety—it is good practice to draw off the fluid, to enable the surgeon to apply his pressure with more certainty and better effect. It is of no use to attempt to cure the hydrocele itself, for it is to be remembered that the hydrocele is the direct consequence of the diseased testis, and that it is of little use treating the effect of a diseased condition and not its cause. Remove the latter, and the former will probably disappear; cure the orchitis, and the hydrocele will generally go.

I have the records of a case which passed under my care for treatment, in which by some oversight this attempt had been made, and the hydrocele was tapped and injected with iodine on three different occasions, without success. Under the subsequent treatment the chronic orchitis disappeared, and with it the hydrocele.

It is not always desirable, nor is it possible in a large proportion of cases, to keep the patient absolutely at rest during the process of treatment. In some examples it is advisable to do so as much as possible, particularly when the patient experiences more pain and inconvenience when walking or moving about, but in the majority of cases it is sufficient to keep the parts well supported by an elastic bandage or strapping.

In the consideration of the treatment of chronic orchitis it has been stated that a good recovery may generally be secured by the means which have been suggested, when the disease has been taken in hand at an early period of its existence; that is, when not more than five or six weeks have been allowed to elapse. But in cases of longer standing the prognosis is not so favorable, either as regards the removal of the disease, or the subsequent integrity of the part as a seminal gland, and these remarks more particularly apply to the syphilitic form of the affection; for, if of long standing, the fibrinous matter has generally become too well organized for future absorption, and, when this is the case, the subsequent contraction of the organized product will almost to a certainty go on to the destruction of the seminiferous tubuli, and the production of an atrophy of the gland. In the Guy's Hospital Museum are several admirable specimens exhibiting this result.

In certain examples, again, of chronic orchitis, whether syphilitic or otherwise, suppuration and disintegration of the gland structure will take place. This termination may be suspected when the disease is of a very torpid character, when the pain is of a constant aching kind, and when all treatment fails to influence its course.

When pus has formed, its early evacuation is the best practice, for a clean incision or puncture into the part often prevents that destruction of the glandular structure, and of the fibrous covering of the gland, which usually precedes that troublesome affection, *hernia testis*.

On Tubercular Disease of the Testicle.—Tubercular disease of the testicle may attack any part of the organ—that is, either the seminal gland or its duct. It may affect these parts separately or together. It may show itself either in the form of an infiltration of the so-called miliary tubercles, or in the more distinct and usual condition of the yellow, cheesy unorganizable material described as crude tubercle. When appearing in the form of miliary tubercle, it is not characterized by any very definite symptoms; indeed the infiltration of a gland with those small, gray miliary bodies seldom makes itself known by any visible signs, and it is to be suspected only when a rapid disorganization of the part takes place, after an attack of acute or chronic inflammation. Organs thus infiltrated have no power of resisting the inflammatory process, and, whether it be a lung or a testicle which is the seat of this affection, active breaking up of tissue generally takes place, with suppuration. We shall exclude from our present consideration those interesting cases, remembering that pathologically they are clearly to be recognized, while practically their presence can only be suspected when the result to which I have already alluded takes place.

The other form, however, of tubercular testis is characterized by more special symptoms and local conditions. It may involve, as already stated, either the body of the gland or the epididymis, but, without doubt, the latter is the more frequently diseased. It is discovered, as a rule, accidentally by the patient, and frequently not until some secondary change in the structure is about to show itself. It appears primarily as an indolent, painless enlargement of the epididymis, and is described usually by the patient as a lump in the testicle, this lump appearing generally at the upper part. This symptom is, in all probability, the only one to which attention can be drawn; the surgeon will recognize it at once on manipulation, for the tubercular matter will feel as if some foreign body, as a pea, bean, or nut, had been placed between the convolutions of the epididymis, or in the substance of the gland. The gland is not painful on pressure, nor in the inactive stage of the disease does it seem to cause any injurious influence on the organ, which is otherwise natural in its sensation and function.

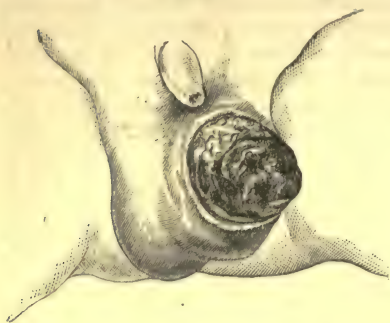
In other cases the disease will appear as a general infiltration of the part involved. Should this be the epididymis, the part will be enlarged, indurated; and nodular, painless perhaps, and inactive, the body of the testis resting on the concavity of the affected portion, apparently sound. Should the body of the gland be the part affected, like symptoms will be present, the enlargement, however, showing itself in the secreting structure as an equal and nodulated expansion of the part; the epididymis, or seminal duct, being quite distinct.

This inactivity of the disease does not, however, remain forever—it may last months, or even years—but the time will come, in all probability, when the tubercular matter will begin to soften down, and thus excite some increased action in the parts around. It may be that this increased action in the part will first draw the patient's attention to his affection, when the history of some previous thickening of the organ will be for the first time obtained. When inflammatory symptoms are once developed, the disease will surely make rapid progress, and disintegration of this unorganizable tubercular matter will speedily follow, accompanied with suppuration.

In tubercular epididymitis—for such this disease may be named—local suppuration will soon appear, with the discharge of ill-formed pus and débris, showing itself as a curdy, friable, and granular material; sinuses are apt subsequently to form, which may go on discharging for a variable

period, this point depending on the extent of the disease, and the amount of foreign material there is to disintegrate and soften.

FIG. 271.



earthy concretion. We see the same

Should the body of the testicle be the part implicated, the same gradual softening and suppuration will take place, and, too often, the formation of the hernia testis to which allusion has been already made. It is not, however, in every case of this disease of the testis that disintegration of the tubercular material is to be expected, with its accompanying suppuration and abscess; for in many examples no such result is to be found, this tubercular matter undergoing a gradual change, and showing itself after death as an changes in the absorbent glands, in

the lungs, and in other parts. Tubercular disease of the testis may occur at any age, but seldom before adult life. The best example, however, that I have ever seen was in a child aged two years, whose testicle I recently excised, for tubercular disease of six months' standing; it had progressed very slowly, and had acquired a large size before suppuration occurred. Convalescence followed the operation. (Fig. 271.) The whole organ was nearly filled with serofulous deposit, and the epididymis likewise. It is in this organ that we have the best opportunity of examining the true tubercular disease in its different stages, and of watching the various forms of its deposition, its changes, and its decay.

Treatment of Tubercular Disease of the Testicle.—When tubercular material has been once deposited in a testicle, as in any other tissue, there are no recognized means by which the absorption of this material can be procured. It is true that it may remain for an indefinite period in an inactive or passive condition, and finally, by undergoing an earthy degeneration, cease to trouble; nevertheless, it will still exist, ready, as it were, on the least disturbance, to light up some inflammatory action in the tissues around, and give rise to any or all of the various conditions just described.

Looking also upon the deposition of tubercle in a testicle as only one of the local manifestations of that general condition described as tuberculosis, it is clear that the principles of treatment should be of a general character to improve the health, and revive the powers of the patient by tonics; good living, good air, regular habits, and, what is of great importance, total abstinence from sexual excitement or gratification. Beyond that nothing can be done. Locally, the parts should be maintained as much as possible in a quiet condition, and cold sponging night and morning is of some service.

When inflammatory symptoms make their appearance, they will generally run their course, in spite of treatment; for, as already shown, they are usually caused by the breaking down of the tubercular deposit, and may be looked upon as one of nature's means for its elimination, and until this material has, consequently, been discharged, their subsidence is not usually to be looked for; fomentations in this stage are, therefore, suitable, and the application of water-dressing to the part, and support in a suspensory bandage, should be employed. When suppuration is nigh at hand, or has manifested itself, it is good practice to open the abscess freely with a lancet,

for it saves time and pain to the patient, and often prevents the formation of the sinuses which prove so troublesome. During all this time the health of the patient should be attended to by ordinary measures.

When the gland has attained a large size, and is evidently destroyed by abscesses and disintegration of the infiltrating material, it may be excised, and more particularly if hernia testis has appeared. Still the surgeon should not be in any hurry to operate in these cases, for the subjects of this affection being tuberculous, are not favorable ones for operation, and castration should consequently only be performed where a strong necessity exists, and the disorganized testis is a source of trouble and weakness to an enfeebled patient.

On Hernia Testis.—This affection, which has been variously described as “granular swelling” and “benign fungus of the testis,” has also more correctly been called hernia testis, for it is essentially a gradual protrusion of the substance of the gland through a rupture or ulceration of its fibrous envelope, the tunica albuginea. It may follow upon suppuration of the body of the gland, the result of an injury, or of an acute or chronic orchitis, or from the softening down of tubercular deposit. It seems to be the result of pressure, produced by the natural elasticity of the fibrous tunica albuginea, the testicle as it were being gradually squeezed out of its capsule and everted, the mass being eventually increased by the free granulations which spring up on its surface. The whole organ, or only a portion of it, may be thus extruded from its natural position, the extent varying according to the amount of disease and the size of the opening in the tunica albuginea and integuments. It must not be supposed, however, that this hernia testis is the necessary consequence of suppuration, or of disorganization of any portion of the gland, for such is not the case; in the majority of instances it does not ensue, still in a minority it is certainly found, and in such requires consideration.

The diagnosis of the affection is not difficult, and having being once seen, should be subsequently readily made out. It is a peculiar fungating-looking growth, with everted edges, and with a sinus in its centre generally secreting pus; it may be of variable extent, and may also present a more or less irregular surface, and on examining its base, it will be seen to be in a measure pedunculated, the pedicle passing through an opening in the scrotum to the remains of the testicle. The margins of the opening in the scrotum will be seen to be generally free, although in some cases adherent to the growth. It may be slightly indurated from inflammatory thickening, but will never present the same aspect as a cancerous growth, for which, however, this affection may be mistaken, the term fungous testis having doubtless been the means of encouraging the great error of regarding this simple disease as a malignant one. The natural sensation of the gland remains, however, in these cases, and will be readily excited on manipulation. In cancerous disease no such natural sensation exists, and in doubtful cases this point is one of primary importance.

Treatment of Hernia Testis.—It may be safely stated that the majority of cases of hernia testis can be successfully treated by other less severe measures than castration—an operation which has been very generally performed for this affection by surgeons of the past generation. In exceptional instances it may be demanded, and I have the records of many cases in which it has been successfully performed. The surgeon’s object, it may be briefly stated, is to restore the extruded testicle to its natural place, and this may frequently be done by simple pressure, applied by fixing a good firm pad over the surface of the growth, and drawing well forward the margins of the ulcerated scrotum, fixing the whole in position by strap-

ping. In other cases, where the granulations are very exuberant, caustics may be used to hasten their destruction; and amongst the best is the red oxide of mercury, pressure being well maintained during its use. All minor cases, and many severe ones, may certainly be cured by these means, if steadily pursued and well applied. In the more obstinate and severe examples other measures must be adopted. The excision of the surface of the growth was formerly employed, and is so at times in the present day, but the practice, at best, is a very doubtful one, for in the majority of cases to which it is applicable it would be tantamount to castration, as the fungating mass is as a rule composed of the everted tubules of the testis, covered with granulations, and consequently by this measure the tubules would be cut off and the gland destroyed.

Mr. Syme described, in the "London and Edinburgh Monthly Journal" for January, 1845, a plan of treatment which in these cases is very serviceable, although I would add that it is only in quite exceptional examples that it can be called for. The operation consists in the elevation of the margin of the scrotum from the protruding mass, the reduction of the hernia testis within the scrotum, and the retention of the part in its natural position by a careful stitching together of the margins of the wound, careful bandaging and strapping being also required in the treatment of these cases. The granulating organ becomes attached to the inner surface of the scrotum, and a healthy action is subsequently restored. It is almost needless to add, that local and constitutional treatment for the original affection of the testis should be maintained at the same time.

On Cystic Disease of the Testicle.—There is no disease of the testicle upon the nature of which there has been a greater difference of opinion than cystic disease, and, although modern pathologists have devoted considerable attention to its investigation, the subject has not yet been brought out of its obscurity and made plain to the profession.

Sir A. Cooper, one of its original describers, looked upon it as a distinct disease of the secreting *tubuli* of the organ, and upon his authority this view was for a time generally received. But more recently Mr. Curling's researches have tended to prove it to be an affection of the *ducts* of the testicle, and not of its secreting tubuli. "Why they alone," says Mr. Curling, "are subject to the morbid change, I admit my inability to explain." Whether this opinion be correct or not will be one of the subjects for present consideration; for I am disposed to think that it is not quite consistent with observed facts, although there can be no doubt that the rete testis appears to be the seat of the disease in certain cases, while in exceptional examples cystic disease is undoubtedly formed independent of this structure.

It has been my privilege to examine many examples of this rare affection with some care, and in the main points of Mr. Curling's investigations I entirely concur, although I am not so sure of the special seat of the disease as he appears to be. The disease is doubtless made up of cysts which are multilocular and of various sizes, from that of a mustard-seed to a moderate-sized nut. These cysts are filled with a thin, serous, blood-stained, or glairy fluid, and at times they contain intra-cystic growths more or less pedunculated, made up of a delicate cellular structure, or of a distinct cell tissue. These cysts appear to be imbedded in a fibrous stroma, of different degrees of consistency and density—in some instances the fibrous elements being much more numerous than in others. In some it will be of a delicate nature, and more allied to the fibre structure found in the ordinary fibro-plastic growths of other parts. In certain examples the cysts appear to be clearly made up of dilated tubes, pouches appearing at their extremi-

ties or as lateral dilatations, these tubes being occasionally lined, as Mr. Curling was the first to state, with tessellated epithelium, and containing granular matter. I have failed, however, to find this in all the cases I have examined, and am disposed to look upon the presence of this tessellated epithelium as specially characterizing a certain growth. Spermatozoa are invariably absent in the cysts or tubes of this affection. Enchondroma or bony material will almost always be found to exist; in some examples as small isolated patches, in others the cyst will be filled with such a material, and under such circumstances the growth might be described as an enchondromatous tumor, the cartilage being deposited in separate masses, and these masses being divided by a fibrous stroma. The true secreting portion of the testicle will often be found pushed up into some corner of the tumor, or spread out over the cystic mass, or distributed between the cysts themselves, the tumor being invariably encysted in its own capsule; and, in rare cases, tumors of this nature will be found upon the cord and body of the testicle. The above facts, therefore, lead me to believe that the majority of these are new growths, following the great law which governs the development of all tumors, by taking on the likeness of the part in which they are developed; that they are more or less built up as is the structure of the normal gland. The testis being essentially a tubular organ, all morbid growths developed in or near it have a tendency to assume a tubular or cystic character, this character varying in extent in different cases; the cystic or tubular, and fibrous or fibro-plastic structure, being found in different degrees of perfection and quantity in different cases.

We may thus find in the testicle a tumor presenting all the elements of the fibrous or fibro-plastic tumor without cysts, whilst in another the same elements will exist in less proportions, the cystic formation more or less predominating; and in the majority of these examples the true structure of the testicle will be found spread out to a variable extent over the special capsule of the new growth. In other cases the new growth will be altogether free from any connection with the testis itself, and will be found growing from the cord. All these separate kinds of tumors, examples of which may be seen in the Guy's Museum, appear to me merely modifications of one kind of growth,—the simple, or perhaps more correctly, adenoid growth of the testis.

We thus see a close analogy between these tumors of the testis and those of the mammary gland, as well as of the ovary. We find in all the simple adenoid tumor, partaking more or less of the nature of the gland in which it is developed; and we find a true cystic disease of the gland itself, the latter being evidently a special affection of the tubes and ducts of the mammary gland or testis, and not of the secreting structure; in both organs they are new growths, simulating, more or less correctly, the anatomical structure of the true gland.

FIG. 272.



Symptoms and Diagnosis.—Having dwelt as long as space will allow upon the special pathology of these diseases, I will pass on to consider it in its clinical aspect, and to point out the symptoms which indicate its presence, and which help us to the formation of a correct diagnosis. In doing so, I must premise that the several forms of this cystic disease are to be recognized more by negative than positive signs, for they appear usually as painless enlargements of the organ; they are of slow growth, unaccompanied by any symptoms such as attract attention, the patient seldom seeking advice until the organ from its size has become troublesome, or the dragging pain in the loins—which always exists when the testicle has become large and heavy from any cause—excites anxiety. The organ soon loses its natural shape, and assumes more the oval or pyriform outline of a vaginal hydrocele or hæmatocele. It will probably have a smooth and equal surface, and will be indistinctly fluctuating; it will not, however, be translucent. The natural sensation of the testis experienced on manipulation, will very likely have disappeared at a very early stage of the disease. The general health of the patient will probably be good, and there will be no evidence of any secondary glandular affection. The disease may generally be recognized by these conditions; the history of the case, the opacity of the tumor, and the loss of the natural testicular sensation, distinguishing it from hydrocele and hæmatocele; and when doubt exists, an exploratory puncture by the trocar and canula will decide the point, for in cystic disease a little bloody and glairy fluid will alone escape. From the inflammatory affections they may be diagnosed by the difference in the shape and feel of the tumor, for in the different forms of orchitis the organ maintains its flattened form from side to side, feeling hard, nodulated, and tender. In the cystic disease the tumor is generally more or less globular or pyriform, feeling smooth and elastic, and being senseless. The inflammatory affections are also often associated with a hydrocele, the cystic but rarely, if ever. In the former, also, both organs are generally affected sooner or later; in the latter, the disease only attacks one. Medical treatment does not appear to have any influence in arresting the development of the cystic disease, whilst in the inflammatory a good recovery may generally be secured by the use of proper remedies.

Treatment of Cystic Disease.—There is but one remedy for this affection, and that is the removal of the diseased organ. No drugs seem to have the slightest effect in diminishing its size or arresting its growth; and excision should consequently be performed, the operation being, as a rule, most successful.

On Cancer of the Testicle.—The testicle, like all glands, may become the seat of cancerous disease, both of the carcinoma-fibrosus or hard cancer, and of the carcinoma-medullare or soft cancer. It is rare, however, for the hard cancer to attack the testis, the majority of examples being of the soft or encephaloid form. For one example of the hard cancer it is probable that at least twenty of the soft are met with in practice. In the different museums a few specimens may be seen of the former kind, and at Guy's several exist.

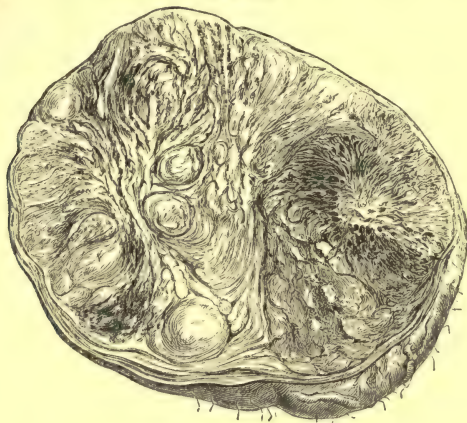
Cancer may attack this organ, likewise, in two forms—either as the tuberosus or the infiltrating cancer. In the former class the disease appears either as an isolated growth, or as several distinct tumors separating the parts and then eventually coalescing into one mass. In the latter it appears from the beginning as the infiltrating kind, being more equally distributed between the tubes and ducts of the true secreting gland tissue.

This disease has one peculiarity which is worthy of notice, and that is the tendency there is in the malignant as in the simple affection of the

organ to be accompanied by the development of cysts, and these in the malignant cases are filled with cancerous matter, in lieu of the glairy mucous or fibro-cellular intra-cystic growths which are found in the fibro-plastic, adenoid, or cystic diseases. In rare examples both conditions seem to coexist in the same organ; simple cysts, with the clear or blood-stained glairy fluid, existing in one portion, whilst in others these cysts are filled with cancerous material, and in a third enchondromatous masses may at times be present. (Fig. 273.)

The body of the gland is the part of the organ generally attacked, although the epididymis may be the seat of the disease; but when the

FIG. 273.



latter is involved it is as a rule an extension of the disease from the body of the tumor. Rare examples, however, exist which illustrate a primary affection of the epididymis. Cancer may occur at all ages, cases being related, by different authors, of this disease attacking infants even so young as seven months; and I have excised a cancerous testicle from a boy only two years old.

Cancer may attack the testis of the old as well as of the young, and I have the records of cases occurring in men aged 56 and 62, respectively. The majority of cases occur, however, in young adult life, from 25 to 40, as indicated by the following facts.

I possess the records of sixteen cases, and I purpose to add them to the fifty-one examples originally tabulated by Mr. Harvey Ludlow, in his Jacksonian prize essay. The results are as follows:

Before the age of 5	. . . . .	6 cases.
From 15 to 20 years	. . . . .	2 "
" 20 to 30	. . . . .	16 "
" 30 to 40	. . . . .	27 "
" 40 to 50	. . . . .	8 "
" 50 to 70	. . . . .	8 "
		<hr/>
		67 "

Out of my 16 cases the disease had been growing for one year or less in 11, and in the remaining 5 cases three, three, four, four, and five years respectively.

It is rare, if not unknown, for both testicles to be the seat of cancer at the same time; I am not aware of any such example being on record. In 10 out of the 16 cases before me the right organ was attacked, in 6 the left.

Cancer of the testicle may come on as insidiously as the simple cystic disease, but in general its growth is more rapid. It makes its appearance as a gradual enlargement of the body of the organ, and is seldom attended by any pain. There is also an early loss of the special testicular sensation on pressure or manipulation. The outline of the tumor is also smooth, semi-elastic, and fluctuating, although as the disease progresses its surface may become somewhat uneven or irregularly bossy, the tumor being harder in some parts than in others, the softer parts projecting. In the carcinoma fibrosum, however, the whole tumor is hard and at times nodular.

It is very rare for the disease to progress sufficiently far for the skin and fibrous tunics to ulcerate, and for a bleeding fungus to form; the tumor must be very large for such a result to take place. The integuments are generally also free from the beginning—the disease being confined within its fibrous coverings. As the disease progresses and the health of the patient suffers, a general aspect may appear indicative of exhaustion and some wasting disease, although it is not till a late period of this affection that any such symptoms are to be expected. There may be also more or less lumbar pain; when a constant aching exists, a suspicion of enlarged lumbar glands should be excited, and in certain examples these may be felt extending upwards along the psoas muscle.

The inguinal glands are also occasionally enlarged from evident infiltration. It is believed by some surgeons that this complication does not appear till the scrotum is involved in the disease, but this is certainly not the case, for enlarged inguinal glands may appear at an early stage. It is the size of the organ which generally first draws the attention of the patient to the part, and the pain and inconvenience caused by its weight, which prompt him to seek advice. The tumor is also opaque from the beginning, and is rarely, if ever, associated with any hydrocele—when it is, it is by a chance, the one affection having no direct relation to the other. In this respect it differs from the ordinary inflammations of the organ, which are very frequently complicated by the presence of a hydrocele.

The diagnosis of this disease is by no means easy, particularly in its early stage—indeed in many instances it is almost impossible to be certain of its nature.

The history of the case and the absence of translucency will prevent its being mistaken for a hydrocele. Hæmatocele has also a distinct and special history of its own, and the fact that the testis may be made out to exist in some portion of the tumor is a material aid to the surgeon in forming a correct opinion as to the nature of the case.

The tenderness of the organ, the nature of the pain, and the shape of the swelling, are sufficient to indicate the inflammatory affection, and when fluid exists the diagnosis is rendered more plain, for a vaginal hydrocele rarely coexists with any other disease than the inflammatory, except to a very slight extent.

The simple cystic disease is of slower growth than the cancerous, and generally firmer to the feel; when punctured it yields also a glairy fluid, unlike the creamy material which comes away from the cancerous disease. The subject of diagnosis, however, of all these growths will be discussed hereafter.

TREATMENT.—The only treatment which gives any comfort to the patient is excision of the organ; it should be done, however, as early as the diagnosis can be made, for there is then less chance of the glands in the loin becoming involved. The general health must also be looked to with great care at the same time.

On the Diagnosis of Scrotal Tumors.—I propose now to consider the subject of diagnosis of scrotal tumors as a whole, to describe the train of thought as it passes through the surgeon's mind in his attempt to diagnose a tumor of the testis, and to point out the special symptoms, or their combination, as they tend to indicate the presence of any special affection. Fully recognizing the great difficulty so frequently experienced in forming a positive opinion as to the nature of a scrotal tumor, I believe that a near approximation to truth may generally be made when the history of the case, and its special symptoms, are carefully weighed, and I am not disposed to place amongst the impossible the diagnosis of a scrotal tumor, because occasionally great difficulty may be experienced, or it may be beyond our power to form any positive opinion upon the point. There are gradations of probability in all our conclusions as to the diagnosis of any disease, a certainty untainted by fallacy or doubt is rarely obtained, and I take it, we are as often correct in our judgment of a scrotal tumor as we are of any other affection. To aid the student in this task the following table has been drawn up. (Pages 584, 585.)

The first point the surgeon has to decide, on being consulted as to the nature of a scrotal tumor, has reference to the question of hernia. Is the tumor connected with the testicle? or has it passed down the direction of the cord from the abdominal cavity? Should the surgeon be able to isolate the growth at its neck from the abdominal cavity by the thumb and finger, the question is at once decided, for almost all scrotal tumors can be so isolated, it being quite exceptional for any to pass up the cord so far as the internal ring. Rare cases of vaginal hydrocele, or hæmatocele, in which the tunica vaginalis is open up to the internal ring, form an exception.

This important preliminary point having been decided, the nature of the growth claims our attention next.

Is it a hydrocele or a hæmatocele? Is it the product of inflammation or of tubercular disease? Is it a new growth altogether, and if so, is it innocent in its nature or malignant?

Should the tumor prove translucent by transmitted light, the existence of a hydrocele may fairly be decided, although the form of this affection may yet be doubtful. Is it an ordinary vaginal hydrocele, or is it encysted? Should the tumor be large, even, and pyriform, and should the testis be found, either by means of manipulation or by the opacity displayed at one spot on transmitting light—at the posterior part of the tumor—vaginal hydrocele may be suspected; but should the testis exist in front or at one side, and should the tumor be small and have been of very slow growth, and should it be more or less globular or evidently multilocular, a cystic hydrocele may probably be diagnosed. The tapping of the tumor will, however, settle the diagnosis; for in vaginal hydrocele the fluid will be more or less straw-colored and albuminous; in the encysted it will be thin, non-albuminous, pale, and probably opalescent, containing on microscopical examination granules and spermatozoa.

The presence of hydrocele is thus readily decided in the majority of cases, but in rare or old instances the tumor is at times opaque, thus complicating the diagnosis. The history of these cases will, however, tend to throw much light upon the point, for it will to a certainty reveal a disease of very long standing; the tumor will be probably painless and fluctuating, and the testis will be made out in its usual position at the posterior part of the sac. Should a doubt exist, a puncture with an exploring trocar and canula will decide the question, for in these cases fluid will be drawn off of a dark color, loaded with cholesterin.

TABLE OF DIAGNOSIS OF CHRONIC

Symptoms.	Hydrocele.	Hæmatocele.	Chronic Orchitis.
<i>Condition of tumor.</i>	Tense, usually transparent, fluctuating.	Tense and elastic; <i>not</i> transparent; <i>obscure</i> fluctuation.	Firm, and not elastic; <i>not</i> transparent; not fluctuating unless complicated with hydrocele.
<i>Outline.</i>	Smooth and uniform.	Smooth and uniform.	Smooth and compressed laterally.
<i>Position of testis.</i>	Posteriorly in <i>vaginal</i> . Anteriorly at side, or below in <i>encysted</i> .	Posteriorly.	Evidently an enlarged testis.
<i>Testicular sensation.</i>	Present on manipulation.	Present on manipulation.	Present at first; absent after long existence of disease.
<i>Rapidity of growth.</i>	Gradual, most so in <i>encysted</i> .	As a rule sudden, and after accident, at times spontaneous.	Slow.
<i>Size.</i>	To great dimensions in <i>vaginal</i> ; moderate in <i>encysted</i> .	Moderate.	Rarely more than 3 or 4 times natural size.
<i>Form.</i>	Pyriiform or oval in <i>vaginal</i> ; globular in <i>encysted</i> .	Pyriiform, or oval.	Oval, with flattened sides.
<i>Pain.</i>	Very slight, if any, except when complicated with inflamed testis, and in acute hydrocele. Not increased on pressure.	Painful at first, and at a later stage; not so during the intermediate.	Dull pain, increased on pressure, except in very chronic disease.
<i>Manipular indications.</i>	Like fluid, vibration on palpation.	Firm and solid.	Firm and solid, unless associated with hydrocele.
<i>Seat of its commencement.</i>	In <i>vaginal</i> , at the lower part of the tumor. In <i>encysted</i> , at the upper.	.....	Evidently in body of gland.
<i>Cause.</i>	No recognized cause.	An injury or strain, rarely spontaneous.	Injury; or idiopathic.
<i>Progress.</i>	Has a tendency to remain tranquil, and not to inflame, unless injured.	Has tendency to inflame and suppurate, and not to remain tranquil for long.	Slow growth; rarely, but at times ends in suppuration.
<i>Condition of cord.</i>	Free and healthy.	Healthy.	Often full and tender on manipulation.
<i>Results of tapping, exploratory or otherwise.</i>	Straw-colored, fluid serous in <i>vaginal</i> ; limpid, opalescent in <i>encysted</i> .	Blood fresh, or broken up with pus.	.....
<i>Condition of inguinal and abdominal glands.</i>	Free and healthy.	Healthy.	Healthy.
<i>Complications.</i>	Inflamed testicle.	None, unless hydrocele, or injured testicle.	Occasionally with hydrocele.
<i>Organs involved.</i>	Occasionally double.	Never double.	Generally both organs, either separately or together.

DISEASE OF THE TESTICLES.

Syphilitic Orchitis.	Tubercular Disease.	Cystic, or Adenoid disease.	Carcinomatous disease.
Very solid, but not elastic or transparent unless complicated with hydrocele, which is very general.	Indolent indurations in body of gland or epididymis, like foreign bodies. Towards the end these bodies soften and excite suppuration.	Firm and elastic; insidious enlargement of gland; not translucent; indistinct fluctuation.	A tense and firm enlargement of body of testis; not translucent. Indistinct fluctuation towards later stage; bossy outline; parts softer than others.
Irregularly nodular, and very hard.	The epididymis the most frequently involved.	Generally regular, elastic, and smooth; rarely bossy. -
In tumor.	In natural position often half surrounded by epididymis as a half crescent.	In tumor.	In tumor.
Absent altogether, except in very early stage; returns also towards convalescence.	Present.	Present at first, but soon lost.	Soon disappears.
Slow in the extreme, often hardly noticed.	Slow at first; rapid afterwards, when softening and inflamed.	<i>Unequal</i> ; slow at first, more rapid afterwards.	Rapid, as a rule; slow only in the carcinoma fibrosum, which is very rare.
Moderate.	Moderate.	Rarely, but sometimes very large.	Sometimes very large.
Irregularly oval and lumpy.	Lumpy; uneven in all its stages.	Oval with flattened sides. Smooth at first, subsequently bossy.	Globular or pyriform. Smooth at first, subsequently lumpy, softest at these points.
Very slight, allows rough handling. Towards end of disease, on recovery, pain on pressure returns.	Very slight pain or tenderness, except when pressed hard or inflamed.	Slight when present; generally painless, even on manipulation.	Very slight, even on free manipulation.
Very hard and irregular outline. Often hydrocele, with small fibrous bodies in tunica albuginea.	At first as if foreign bodies existed in the parts, lumpy. At last soft before suppuration.	Firm and elastic, more so in one spot than another.	Firm but elastic; softer on the bosses, when present.
Always in body of gland.	Generally in epididymis; occasionally in body of gland.	In body of gland.	Body of gland.
Constitutional syphilis, hereditary or acquired.	Tuberculosis.	Unknown.	Unknown; occasionally from injury.
Essentially chronic; rarely terminates by suppuration.	Very indolent and insidious; tends to inflame and suppurate after an uncertain period.	Unequal; never inflamed.	Rapid, as a rule; rarely slow.
Free.	Healthy.	Healthy.	Full; veins enlarged.
.....	.....	<i>Mucoid fluid</i> , more or less bloodstained.	<i>Blood or creamy fluid</i> , with characteristic cell-growth on microscopic examination.
Generally indurated.	Generally indurated.	Rarely involved.	Generally involved.
Hydrocele, almost always. Other syphilitic affections.	Rarely with hydrocele. Disease in other parts of body.	Rarely with hydrocele.	Cancer in other parts; rarely with hydrocele.
Often both organs.	Both organs, as a rule, involved.	Always single.	Single, as a rule.

We will now pass on to the consideration of tumors which are not translucent, and not hydrocele, and it is here that the surgeon experiences true difficulty in his diagnosis, for almost all the diseases of the testis are insidious in their growth, and most are painless in their development. The hæmatocele usually follows upon some strain or injury, and increases with tolerable rapidity up to a certain point, and is accompanied with pain which soon subsides; it then becomes stationary as to size, and remains torpid for a variable period, when pain again appears, with other signs of inflammation. The presence of the testis is also to be made out by manipulation towards the posterior part of the organ. The surface of the tumor is always smooth, more or less oval or pyriform, and semi-elastic or fluctuating.

The inflammatory affections of the testis have a peculiar shape, being laterally flattened; they are usually accompanied at some period of their course with tenderness and pain, and often associated with fluid in the tunica vaginalis. In the syphilitic inflammation this fluid is often copious. Both organs are also generally involved, either together or at different times. The tumor is usually somewhat tender to the touch, and has a firm fibrous feel, unlike the semi-elastic and half-fluctuating sensations given by cystic or carcinomatous disease. In very chronic cases the testis may, however, be perfectly painless, and will allow of any amount of manipulation without distress; the natural testicular sensation will also have disappeared. In syphilitic disease the surface of the tumor will probably be irregular, with firm fibrous outgrowths in different parts and in the tunica albuginea.

In the tubercular affection of the epididymis or testis there should not be any difficulty in the diagnosis, for the tubercular deposit, as a rule, takes place unaccompanied with any pain, or any symptom beyond that produced by its deposition. When deposited in masses,—its usual form,—it feels like some foreign body introduced into the body of the gland or of the epididymis; it is at first quite painless and unproductive of any symptoms, these only appearing when the material begins to soften down, and excite some inflammatory action in the parts around. The tubercular material may be deposited in one mass or more masses, these subsequently, perhaps, coalescing into an irregular induration. When suppuration takes place, the diagnosis is complete.

The cystic or simple tumors of the testis are painless from the beginning, painless during their growth, as well as on manipulation, and are to be recognized by purely negative symptoms. They attract the patient's observation only from their size; can be handled without exciting pain, and are usually free from even the natural sensation of the organ upon pressure. They are slow in their progress, uniform in their outline, and more or less globular; are always confined to one gland; are rarely accompanied with fluid in the tunica vaginalis; and on being punctured, emit only a more or less blood-stained glairy mucus.

The cancerous tumors of the organ are more rapid in their development than the cystic, a year's growth, as a rule, giving a large tumor; they are likewise painless, and readily allow of free manipulation. The natural sensation of the organ also soon disappears. They are unaccompanied with a hydrocele, and also involve only one organ. They have a more elastic and fluctuating feel than the cystic and the inflammatory enlargements, and when their outline is unequal or bossy, the projection is generally softer than the other portion of the tumor. An exploring needle, or trocar, and canula, rarely, if ever, reveals the mucoid fluid so characteristic of the cystic or simple affections, but usually lets out blood or the thin creamy fluid

so characteristic of a cancer. In the preceding table the chief points of difference in the several chronic affections of the testicle are clearly shown. (See Table, pp. 584, 585.)

Castration.—The scrotum having been shaved, and the skin over the testicle made tense by the surgeon, a free incision is to be made down to the tunica vaginalis testis, and the body of the organ with its cord exposed. A strong whip-cord ligature is then to be passed round the cord, and firmly tied; the cord may then be divided below the ligature, and the tumor turned out of its serotal covering. There is no necessity to take away any of the scrotum, however stretched, unless diseased, for it is sure to contract. All vessels are to be twisted, and a few sutures put in at the upper part of the wound, the whole purse being raised by a small pillow when the patient is in bed. When any doubt as to diagnosis exists an incision into the growth before its removal should be made. When the ligature of the cord has been tightly tied, no pain is caused, and about the tenth day it will come away.

To take the vessels of the cord up singly is a troublesome operation, and has no advantages. No assistant can hold the cord with his fingers before its division; it is sure to slip from his grasp.

To strap a testicle requires some skill. The patient should be made to stand against the edge of a table and separate his legs. The surgeon should then with his left hand grasp the organ from behind, and press it down to the bottom of the serotal sac, making the scrotum tense over its surface, the thumb and index finger of his left hand holding its neck. A piece of elastic strapping spread on leather half an inch or more wide is next to be wound round the neck of the tumor once, twice, or even thrice, to hold it in position, for if this point be not attended to, all the subsequent steps will be useless. (Fig. 274.)



FIG. 274.

Having done this, pieces of strapping three-quarters of an inch long are to be applied vertically from one side of the circular strip to the other, sufficient force being employed to compress the organ. When the testis is completely covered in and compressed, another circular piece or so is to be applied to keep the whole in position, and to bind down the ends of the vertical pieces.

The strapping will probably require reapplication every second day, for the parts soon yield, and the strapping then forms a loose bag. The student is to remember that the object of the strapping is to compress the organ, not only to cover it.

Imperfect transition and malposition of the testicle is occasionally met with, the organ being either arrested in some part of its course into its serotal pouch or malplaced. At times one testicle is found in the canal, or it has failed to put in an appearance at all; at others, both are found out of place. Not uncommonly, this arrested descent of the testicle is complicated with a congenital hernia, the vaginal process of peritoneum being still open, and in all cases of serotal swelling in infants the surgeon should examine the parts with care to make out whether the testicle is or is not involved in the tumor. When the testes are thus placed, they are very commonly ill developed. At times during their descent through the rings they are nipped by the muscular structures, and become inflamed. I have recorded such instances in a former page. Nothing can be done by way of

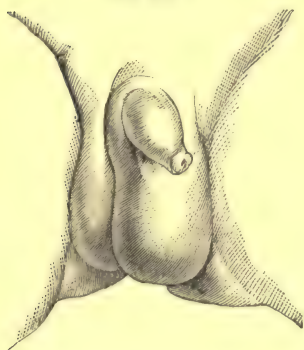
treatment to expedite the descent of the organ when within the internal ring and complicated with hernia, although it is well to recommend a truss; but when the testis is in the canal such an instrument cannot be worn, an extra element of danger under these circumstances being added to the case.

Testes so situated may become the seat of disease, cancerous or otherwise. Many such have been recorded.

In a case recently under my care, of a gentleman over fifty, an encysted hydrocele was found with a small testicle situated in the centre of a congenital hernia, the cyst appearing on the reduction of the hernia as a tumor the size of a small orange, below the external ring and behind the hernia. I tapped it from behind, and drew off about two ounces of a milky fluid containing many spermatozoa, and injected it with iodine with a good result. This gentleman was married, and had a family.

Malplaced testicles are less common than those just described. I have, however, seen four cases; in two, one of which I have recorded ("Guy's Hosp. Reports," 1867), the right testicle was placed in the perinæum in its own independent scrotal pouch (Fig. 275), and in the two others the right testicle was in the perinæum, the scrotal sac being otherwise natural. There was in one a hernia associated with the malplaced testicle; the bowel clearly descending into the tunica vaginalis down to the testicle.

FIG. 275.



Varicocele.—This signifies a varicose condition of the spermatic veins, and when the disease is well marked their tortuosity and dilatations present the appearance and impart the feeling of a "bag of worms" within the scrotum. It is more common on the left side than the right; the more dependent position of the left organ and the liability of the vein to be pressed upon by a loaded

sigmoid flexure of the colon being the assigned causes of this preponderance. It is a disease of young adult life, and is doubtless often, although not always, the product of masturbation, or excess of venery. Anything that retards the return of the venous blood from the organ aggravates, if it does not cause it. The affection is generally accompanied by a dull aching pain in the part, a sensation of weight or fulness, but these symptoms are rarely complained of at an early period of the affection; the pain often passes up the groin even to the loins. It is relieved if the patient assume the recumbent position, and even by elevating the scrotum.

TREATMENT.—It is to be treated on rational principles. Should constipation exist, the bowels must be regulated. Should the scrotum be pendulous, cold bathing is to be recommended, and the organ supported by means of a thin suspensory bandage. Tonics are often of use. When this palliative treatment gives relief, and retards the progress of the disease, nothing more is needed; but when the disease is severe, and these means are ineffectual, a more radical treatment is called for, and that consists in the destruction or division of the veins.

This is now generally done by a subcutaneous operation. Some surgeons employ metallic wire for the purpose, others silk or hempen ligatures. Mr. Lee uses two pins to arrest the flow of blood, and performs subcutaneous division of the vessels between them; and in my hands this operation has been very successful. Sir B. Brodie used to divide the veins subcutaneously

and apply pressure. Wood, of King's, subcutaneously surrounds the veins with a double wire noose, and keeps up pressure upon the wire by means of a metallic spring till division of the veins occurs. Lee's operation is, however, the best; it is to be performed as follows: Under chloroform or not, the scrotum on the side of the varicocele is to be taken between the fingers and thumb, and the vas deferens—which may always be known by its cordy hardness—allowed to escape. As soon as this is done, a needle may be passed through the scrotum, beneath the bundle of spermatic veins, and a figure-of-8 ligature applied over the needle sufficiently tight to arrest the circulation through the veins, but not to cut the skin over them. A second needle is to be applied in like manner, half an inch or more lower down, or higher up, as the case may be; and the veins divided subcutaneously between the two needles, by a tenotomy knife. Sometimes the veins may be divided two or three days after the insertion of the pins, but there is no object in thus waiting. The ends of the needles are to be cut short after the operation, and on the fifth day they may be removed. A day or so later the patient may get up, wearing a suspensory bandage. As a general rule, this operation is most successful, and it is not dangerous. It is only to be done, however, when palliative treatment fails.

Mr. Morgan, of Dublin, has recently suggested an admirable suspender for varicocele and other affections of the testis. It is illustrated in Fig. 276. It consists of a piece of webbing $3\frac{1}{2}$ inches wide at one end, $4\frac{1}{2}$ inches long, 4 inches wide at the other, and cut gradually tapering to the narrower end. A piece of thick lead wire is stitched in the rim of the smaller end, and the sides are furnished with neat hooks, a lace, and a good tongue of chamois leather, two tapes being sewn along the entire length of the webbing, which, when the suspender has been applied to the testicle, are attached to an abdominal belt. The size may vary more or less. The lead wire encircling the lower end gives a foundation to the general means of support, and keeps the testis within the bag; the patient can mould it more or less to his convenience. The suspender need not be worn at night.

FIG. 276.



Fatty tumors are occasionally met with in the cord. I have removed one the size of a walnut; and fibrous or fibro-cellular tumors have been met with on the testicle. I have seen one of the latter the size of an orange excised from the testicle with success by Mr. Hilton.

Affections of the Scrotum.—The scrotal pouch is very frequently the seat of injury, the testicle, from its mobility, escaping. When the parts are bruised the effusion of blood is also very great; at times the blood is effused into the loose cellular tissue of the part, forming a large scrotal hæmatocele; at others the blood forms a distinct tumor. On January 29th, 1871, I was consulted by T. B., æt. 40, who sat down on the broken arm of a chair, the stump of the arm bruising the perineal border of the scrotum. A swelling at once appeared, and when I saw him, twenty-six hours after the accident, a well-defined blood tumor, the size of a cocoa-nut, existed in the median line of the scrotum, the two testicles maintaining their position on either side. By rest, cold lotion, and tonics, the blood was absorbed in three months.

Lacerated wounds of the scrotum are also attended with blood extrava-

sation, but they usually heal readily, on account of the vascularity of the parts.

Œdema of the Scrotum takes place whenever any inflammation attacks the part or the tissues about. It is seen in the inflammation of the epididymis associated with gonorrhœa and in acute orchitis; in extravasation of urine and urinary perineal abscess; in the retention of urine of childhood due to the obstruction of a calculus; in phimosis or paraphimosis; in erysipelas; in all these cases it is present and more or less redness and external signs of inflammation coexist. Simple œdema is often one of the first indications of dropsy, renal or cardiac. The scrotum also is not rarely the seat of *elephantiasis arabum*—solid œdema of the scrotum; the disease generally attacks the penis as well. In tropical countries this affection is common, and the tumors attain an enormous size. It is the same disease as attacks the female genitals and other parts of the body and the extremities; in the West Indies it is the same as the Barbadoes leg. By some observers it is regarded as a constitutional disease. Mr. Dalton, of Guiana, regards it in this light. It is often attended with fever and local erythema associated with œdema, which never subsides. When attacking the scrotum nothing but its excision is of any use. The historical case in which Mr. Key removed from a Chinaman, æt. 32, a tumor, weighing fifty-six pounds (Prep. 1620⁶⁶, Guy's Museum), of ten years' growth (Fig. 277), is a good case in point, but the

FIG. 277.



growths attain a larger size than this. Mr. Wiblin, in 1862, excised a growth equally large, and in the "Med.-Chir. Trans." for 1863, this case with reference to others will be found. Such growths are made up of the elements of ordinary connective tissue. Fayrer, of Calcutta, has operated on many cases. He writes: "The operation for removal of a scrotal tumor is simple enough, but it requires determination and expedition. It needs also the aid of intelligent assistants. Before commencing it is well to have the tumor raised and supported in a vertical position for half an hour, to drain it of blood as much as possible; then, the patient having been placed in a recumbent position on an ordinary table, with the nates brought near the end of it, he is to be put

under the influence of chloroform, and the incisions are to be commenced. Several assistants are required to hold back the legs, raise the penis and testes, support the tumor, and rapidly secure the bleeding points. These being provided the operation may be begun. The director is to be introduced into the passage at the bottom of which lies the glans penis, and that organ exposed by laying open with either the long catlin or sharp-pointed bistoury the dense tissue covering it. If the prepuce is healthy, it is well to reflect a portion of it as a future covering to the penis. If the prepuce is involved or even suspected of being involved it should be carefully dissected away like the rest of the thickened tissue. Having exposed the penis, it is to be raised and carefully dissected out, with or without the prepuce as the case may be. This is to be raised and held aside by an assistant, care being taken in clearing it out of the morbid tissue not to divide the suspensory ligament.

"The next step is to make a deep and bold incision down to the tunica vaginalis on one side. In a large tumor several incisions will be needed before the tunica vaginalis is exposed, which probably will be found much

thickened and distended with fluid, forming large hydroceles. These should be laid open, and if the tunica vaginalis be much thickened it should be removed; if not so affected, and the testicle not enlarged, it need not be interfered with. The testicle is then to be dissected out, reflected and held upwards with the penis. A similar proceeding is to be carried out on the opposite side. The tumor is then to be removed by connecting transversely the three vertical incisions already made, and then, either with the scalpel or amputating knife, the remaining portion of the neck of the tumor is to be cut through. It is well before separating it to mark out on the perineal aspect by an incision the line at which the removal is to be completed. During the operation, vessels are to be commanded by the fingers of assistants, and large veins controlled by forceps. It is well that even the most minute bleeding point should be ligatured (or twisted), otherwise when reaction occurs there may be hemorrhage. The bleeding having been controlled, the testes with their elongated cords are to be applied to the surface of the wound; the penis is to be enveloped in a fold of oiled lint, and thus kept apart from the testes, which are also covered and supported in position by oiled cloths." The largest tumor of this kind on record weighed 200 lbs.

Cancer of the Scrotum is a rare affection compared with what it was some years ago, when sweeps ascended flues; it is commonly met with as a *chimney sweep's cancer*. It is in reality an epithelial cancer, similar to that found in other parts of the body; at times it is very extensive, involving the whole scrotum. Nothing but its removal can be recommended. Small tumors may be cauterized down or destroyed by caustics; larger ones may be excised; but when the growth can be isolated by pins passed through its base, the platinum wire *écraseur* heated by the galvanic battery is probably the best instrument to use—otherwise the knife is to be employed. When the whole scrotum is removed and the testes are left exposed—hanging from their external rings—the surgeon need be under no alarm, for the parts will granulate up in the course of time, and what is more the testicles may become movable. I have seen this take place more than once. The earlier the disease is removed the better, for the glands of the groin may become involved.

The scrotum is occasionally the seat of tumors, sebaceous, fatty or fibrous; these are, however, rare. It is, likewise, the seat of varicose veins; the small venous radicles appearing as beaded dilatations of a peculiar aspect; the disease is, however, of little importance.

Tumors or swellings that encroach upon the scrotum from the perinæum are probably inflammatory, and are most frequently urinary abscesses associated and dependent upon some stricture. Occasionally, however, an anal abscess may press forward. I have lately seen one occupying the whole perinæum up to the scrotum; they are to be treated by a free incision.

CHAPTER LIX.

STERILITY.—MALE IMPOTENCE AND SPERMATORRHOEA.

THE sexual act is so important, and in the mind of most men holds so prominent a place, as to produce on the slightest suspicion of its failure a feeling of depression that in some passes into a kind of mania. The sexual

act is a compound one—it is physical and mental. The physical organs may in their way be perfect and capable; but if the mental are deficient in energy, or weakened by doubt of competency, or under the influence of some emotion, such as shame or fear, the act will be spoilt, and failure to complete it will ensue.

It is thus clear that impotence, real or imaginary, may be due to many causes, physical and mental.

Taylor defines *impotency* "to be an incapacity for sexual intercourse." This incapacity may ensue from remediable physical causes, or from irremediable ones. The latter include loss of penis and testicles, deformity of penis, including excess of and arrest of development, mal-development, in such cases as ectopia vesicæ, &c. The remediable causes may be some local affection of the penis or testes.

Any condition that prevents the introduction of the organ into the female passage is enough to cause impotence, whether penile or scrotal. The same effect is produced from any disease or congenital malposition or development of the testes attended with loss of sexual desire, or old age. A man may, therefore, be impotent and virile, or impotent and sterile.

A man may be capable of sexual intercourse and yet be sterile; sterility in the male depending much upon the secretion of the testes, as well as upon the formation of the penis, for semen destitute of spermatozoa is destitute of procreative power. A man may have a penis the subject of epispadias or hypospadias; he may have sexual desire, and even power, but if the urethral orifice be so low down as to forbid the semen being conveyed into the vagina and uterus, he will be sterile; but all patients with hypospadias are not so. I have known two men who had hypospadias—the orifice of the urethra in each opening one inch behind the normal urethral opening—to be the fathers of three and four children respectively; and a third, in whom the urethral orifice was one inch behind the glans, whose wife died in childbirth.

When the urethral orifice is at the base of the penis sterility must, however, exist. When partial epispadias exists, there is no reason to believe that a man must be sterile.

When both testes are malplaced—that is, when they have not descended into the scrotum—there is a strong probability that the organs are badly developed, that they do not secrete healthy spermatie fluid, and that sterility coexists. Curling asserts this very positively to be the fact, but he at the same time brings forward evidence from Messrs. Cock and Poland's practice that such is not always the case. As a strong argument to the contrary, the case already given (page 588) of encysted hydrocele, with retained testis and congenital hernia, may be adduced. In a general way he may be right, but in exceptional instances wrong; when one testis is in the scrotum, and healthy, there is no reason to suspect sterility.

Sterility sometimes follows disease of the testes, inflammatory or otherwise; for epididymitis, or inflammation of the duct of the testicle, as well as testitis, or inflammation of the gland, may be followed by atrophy of the organ. Gosselin, Godart, and Liegeois have laid great stress upon this; and Curling puts these down as common causes of sterility. Sterility may also be produced by involuntary seminal emissions, the result of excess of venery or masturbation; stricture, or any impediment to the seminal discharge is also another cause. The student must remember, also, that a man may be capable of sexual intercourse and be sterile from other causes. He may even have emissions in connection without seminal secretion, for the emissions may consist only of secretion from the seminal vesicles. I have known this fact illustrated in a man who lost both his testicles from

a surgical operation, and yet had sexual power, attended with emission, as strong as ever. The removal of one testicle seems to interfere but little if at all with sexual power.

In the *female* subject impotency may be said to exist when the vagina is absent or obliterated; it is for a time present when the orifice is occluded from some dense membrane, or when the introduction of the male organ is prevented on account of the smallness of the orifice, by vaginismus, or a double vagina.

Sterility is due to many causes, the occlusion of the os uteri being one, but morbid conditions of the uterus and ovaries are probably the more frequent.

The student should remember, however, that "the functions of the testicle, like those of the mammary gland and uterus, may be suspended for a long period, possibly for life; and yet its structure may be sound and capable of being roused into activity" on any healthy stimulus. Unlike other glands, it does not waste or atrophy for want of use, the physical part of man's nature being accurately adapted to the necessities of his position, and to his moral being.

Spermatorrhœa.—This doubtless exists as a disease, although a rare one. It consists in the discharge of spermatic fluid containing spermatozoa with the urine, without sexual desire or sexual excitement. It is commonly associated with some derangement of the digestive organs, constipation, and rectal irritation, spasmodic action of the levator ani acting on the vesiculæ seminales and prostate gland. In its most complete form it is associated with an absolute loss of sensation about the veru montanum on the passage of a sound, a patient thus affected allowing the introduction of an instrument without flinching; and the worst cases are associated with wasting of the testicles and varicocele. It is at times without doubt due to excess of venery, but more commonly to masturbation. It commences almost always with nocturnal emissions, which gradually become more frequent; at first attended with erotic sensation, they are not so subsequently, and at last occur without erection. If copulation be attempted, the ejaculation takes place at once, often before the introduction of the organ. It ends in the total loss of sexual inclination and power. Lallemand says that seminal emissions supervening during micturition are the most serious.

He holds that "spermatorrhœa is nearly always dependent upon irritation of the prostate gland and its ejaculatory ducts, and believes that in most cases this irritation, which also exists in the neck of the bladder, is the result of chronic inflammation of the urethra in the prostatic portion of the veru montanum. An old attack of urethritis is the most frequent cause of the seminal emissions, and these emissions are often related to stricture of the urethra."

Trousseau, however, while admitting the force of these observations, believes that spermatorrhœa, or incontinence of semen, is due to some imperfection in the nervous system of organic life, for it is so commonly found in men who have had incontinence of urine in childhood. He looks upon masturbation as an indirect proof that there is a bad state of the nervous system, and the subsequent impotence, insanity, or paralysis as an aggravation of a nervous condition, of which masturbation was only the first morbid manifestation. (Trousseau, "Clin. Med.," vol. iii.)

This latter view is supported by the fact that in some cases of injury or disease of the spinal column spermatorrhœa is a common associate.

False spermatorrhœa is, however, a far more common complaint; it is supposed to be present when nocturnal emissions are frequent, when diurnal emissions take place on any sexual thought, and urethral discharge of a

glairy fluid attends defecation, when erections with discharge follow the slightest irritation, such as that produced by riding or walking from the friction of trousers, &c. Such cases are far from rare; they are commonly due to masturbation, but they are not cases of true spermatorrhœa, although they often precede it. Nocturnal emissions may be too frequent, but if associated with sexual feeling they are natural. They should, however, be checked, for they lead on to the true disease. The glairy fluid pressed out in defecation is rarely seminal, it is prostatic, and of a transparent, tenacious character, not milky. The whole genital tract in this affection is in a state of morbid sensibility, of hyperæsthesia, and requires treatment, for the false spermatorrhœa is often only the prelude to the true.

TREATMENT.—Trousseau, regarding masturbation as a manifestation of some disease of the nervous centres, speaks strongly in favor of belladonna, and so far as my experience has gone, I am disposed to think it a valuable drug; given in half grain doses of the extract twice a day with some tonic, such as iron, zinc, strychnine, or quinine, it seems to act most beneficially, and to check the disposition to masturbate in a marked manner. Of course, this good can only be met with when there is in the patient's mind a strong wish to overcome a repugnant habit. To aid this the application of a ring of blistering fluid round the penis, or painting the prepuce with iodine, are valuable adjuncts. The bowels under all circumstances should be kept empty, more particularly the rectum, and the nocturnal injection of cold water into the bowel is a useful habit. The patient should sleep upon a hard bed, not upon his back, and be lightly covered. A solid substance fastened in a handkerchief over the sacrum is a good mode of securing this end.

When evidence exists that the mucous membrane of the prostatic urethra is at fault with the orifices of the spermatic ducts, Lallemand's advice of applying a solution of nitrate of silver (gr. v to gr. x to the ounce) every other day, should be followed. Some surgeons use a stronger solution, and when an absolute loss of sensibility of these parts is present, galvanism has been highly spoken of. For the application of the solution, Erichsen's syringe catheter is the best. Every means should be employed to divert the patient's mind from the seat of his affection, by encouraging mental as well as physical labor. Simple nutritious food should be allowed, and cold bathing adopted.

In the cases of imaginary impotence of young married men all the surgeon has to do is to give confidence, for the failure is probably in the mind of his patient rather than in his body. The best advice is to recommend abstinence from the attempt, when Nature in her own time will have her way, and assert her power.

CHAPTER LX.

SURGICAL AFFECTIONS OF FEMALE GENITALS.

Wounds of the external genitals are always serious on account of the bleeding that attends them, and wounds of the vagina particularly so. These may occur from external violence intentionally committed, or accidentally from falling or sitting on pointed or cutting bodies.

Foreign bodies are also at times introduced into the vagina for criminal or erotic purposes. Mr. Hilton removed at Guy's a flat bone-netting mesh,

ten inches long, which had passed through the vaginal walls into the pelvis; and bottles and other foreign matters have been introduced. Sponges are not uncommonly found in the passage, and in a case I know of, such a foreign body gave rise to the suspicions of cancerous disease. Severe lacerations at times take place in the attempt at coitus. Some years ago I was called to a young married woman for severe hemorrhage from these parts following marital intercourse the night after marriage, and found two severe lacerations of the orifice of the vagina, and the hymen unruptured; the membrane had been practically driven in. Pressure arrested the bleeding.

Wounds of the vagina are apt to be followed by untoward cicatrices.

During childhood the labia are apt to adhere together from some local inflammatory action, and so to close the labial orifice as to interfere with the act of micturition. In children thus affected the urine often squirts in a backward or forward direction, and for this surgical attention is called. On separating the genitals the true condition of affairs will at once be recognized, the labia being connected together by a membranous adhesion, which passes forwards in some cases to the urethral orifice, and thus affects the urinary stream.

The membrane is readily broken down by separating the labia with the fingers or thumbs, or by means of a probe introduced behind it from above. The application of a little cold cream will complete the cure if care be taken to keep the parts clean.

Vulvitis.—This is a common complaint in children; it is almost always due to some rectal irritation, such as worms, scybala, &c., in feeble and badly fed children. It is rarely the result of a gonorrhœal affection, as too often suspected. The student should be aware of this fact, for it is far from common for a surgeon to be consulted about a child which has vulvitis under the suspicion that the affection is the result of some impure criminal contact, when it is due to some simple non-venereal cause.

It is to be treated by local cleanliness, mild astringent lotions, as lead, alum, &c., and by attention to the digestive organs and general health; the administration of a mixture of rhubarb and soda for a few days, and subsequently of a tonic, generally effects a cure. A good mercurial or jalap purge should be given at first when worms are suspected.

Noma, or phagedenic ulceration of the labia, is met with also in cachectic children; it is similar to the cancrum oris after the exanthemata. It is a disease of debility. It commences as an inflammatory swelling of the parts similar to erysipelas, passing on to gangrene and ulceration, and is always attended with great prostration. Tonics such as can be borne should be given; iron when possible, quinine, or bark; milk with chlorate of potash is a good drink; wine and abundance of good liquid nourishment should be given by the mouth or by the rectum when the stomach rejects it. Locally, opium lotion with carbolic acid, nitric acid, or nitrate of silver, should be used, and when the ulceration spreads, nitric acid in its concentrated form may be applied or the actual or galvanic cautery.

Nævi are found involving these parts like others.

In women the labium may be the seat of a *hernia* (inguinal) or of a *varicocele*. The former is known by its own symptoms, the latter by its wormy feel. It may also become on the receipt of an injury the subject of *thrombus* or blood tumor. This is to be made out by the history of the case, the sudden appearance of the swelling after an injury, its external aspect and fluctuating feel. Such blood swellings are to be treated by the local application of cold at first to arrest the flow of blood, and, subsequently, by lead

lotions. Should they tend to break up and form an abscess, a free incision into the swelling is the right treatment.

Labial abscesses at times form as a result of a softened thrombus, but more frequently from follicular inflammation. They are very painful and ought to be opened early. Occasionally they are the consequence of an inflamed cyst.

Labial cysts are very common. They are usually met with on the inner side of the labia, and are similar in their nature to the cysts found beneath the tongue. They are formed in the same way, by the obstruction of the ducts of the mucous glands of the parts. They appear as chronic swellings, at first painless, producing only mechanical inconvenience. If neglected they may inflame and suppurate. They feel on manipulation tense, globular, and semi-fluctuating. Similar cysts are found in the vagina. They contain a glairy fluid, often brown or bloodstained; at times they contain cholesterin. They are to be treated by excision, or by what seems to be as good, the removal by a pair of forceps and scissors of the presenting surface of the cyst, the removal of one wall exposing the other, which contracts; excision is, however, the safest practice. When an opening into the cyst is made, the cavity should be plugged with lint or lint soaked in tincture of iodine, this fluid exciting a fresh action or suppuration in the sac.

The external labia may also be the seat of *sebaceous tumors*, and of a solid œdema or hypertrophy similar to that seen in the male scrotum. In some cases it is a kind of *elephantiasis*; such tumors grow to a large size. Nothing but their removal can be entertained. I removed some time since the labia from a middle-aged woman, both of which had attained the size of a cocoa-nut, with the galvanic écraseur, without the loss of a drop of blood, having isolated the growths by long pins inserted through their bases, and passed the wire round the pins. When this instrument cannot be obtained the knife is to be employed. Such tumors are highly vascular, and the surgeon requires good assistants in their removal.

Cancerous tumors of these parts are also seen, epithelial and otherwise, and it seems that cancer is prone to appear in these regions at an earlier period of life than in others. In 1869 I removed a well-marked cancerous tumor from the labium of a woman only thirty-two years of age. Cancerous tumors of these regions are to be known by their ordinary features, and are to be treated by excision.

Epithelial disease of the clitoris occurs at times. I have seen several well-marked cases, but more commonly it attacks the inner labia and orifice of the vagina. In such cases the benefit of the galvanic cautery is well illustrated, for to remove such growths by excision is very difficult, and is always attended with copious bleeding. When the whole growth cannot be isolated, as much as can be should be excised or scraped off, and the cautery freely applied to the destruction of the whole surface and base. Where the growth can be isolated by the introduction of long pins beneath its base, and a wire adjusted beneath the pins, the galvanic écraseur slowly worked, and not too hot, is an admirable instrument; by its means I have on two occasions successfully removed an epithelial cancer occupying the fourchette of the vagina, encroaching on the passage and the perinæum, without the loss of a drop of blood. The patient was under chloroform during the operation, and felt no pain; the afterpain in these cases is always slight, the cautery entirely destroying the sensibility of the divided parts, and wounds so made heal kindly.

Lupus also attacks these parts like others; and *warty growths* are common.

Syphilis will receive attention in another page.

Imperforate hymen is a condition to be recognized and not confused with the adherent labia already referred to. The hymen is more deeply placed, nearer the orifice of the vagina; when imperforate, it causes retention of the menses, the accumulation of the secretions, and a pelvic tumor, usually accompanied by periodic pain and constitutional disturbance.

The treatment of these cases is by the division of the imperforate membrane or its complete excision, the object being to allow of the free escape of the retained secretion, which is usually black and treacle-like. Success usually attends this practice, but a fatal peritonitis at times ensues.

A rigid hymen is occasionally an impediment to coitus in women who marry late in life, and I have known of a case in which for two years after marriage the husband had never had perfect connection on this account; indeed, it was not till after his wife had become pregnant, and the vaginal membrane had been ruptured during the birth of the child, that a satisfactory coitus had taken place.

I have also been called upon on one occasion to divide the hymen of a lady about thirty who had been married for some months, and had never had complete connection, the husband's penis having been very large.

When a vagina is occluded and the patient has been married, cases are on record in which the urethra has been so enlarged as to admit the finger, and in all probability the male organ.

A double vagina is another cause of difficult coitus. I was consulted in such a case by a patient who had been married for several years, and had never had connection. The woman came to me, as a divorce was under consideration; she complained of extreme pain whenever an attempt was made, and the husband of inability to penetrate. On making a careful examination a double vagina and uterus was made out. I advised the division of the septum by means of the galvanic wire, its introduction above and the gradual division of the septum by means of steady traction upon the wire. Whilst the question was under the consideration of both parties the suspicion of pregnancy occurred, and time proved its truth. A child was born prematurely after a tedious labor, and I heard no more of the difficulties of the case. She became pregnant a second time.

Besides these deformities others may occur, such as occlusion of the vagina or absence of the uterus, or the opening of the rectum into the vagina, &c., &c.

The *clitoris* is occasionally enlarged at birth, appearing as a small penis. I have seen an example of this, and at the end of the clitoris a depression existed corresponding to the male urethra; the child in other respects was natural. This organ may, however, in after-life become the subject of hypertrophy, indeed of a kind of elephas as of the male penis, and require removal.

Clitoridectomy for epithelial cancer has already been alluded to. Of late years the operation has been practiced for epilepsy and supposed erotic complaints, but evidence is still wanting to justify the step. At present, the operation for such purposes appears to be unjustifiable.

Vaginal tumors, besides the cystic and epithelial, are occasionally met with. Vaginal polypi are found. I removed one the size of a nut from a child three years old, and others are on record. They should always be ligatured and excised.

Rupture of the Perinæum.—This is not very rare in rapid deliveries; indeed, in first labors, to a small extent, the accident is a common one; it is of grave importance when the sphincter ani or rectum are implicated, and even when the perinæum is involved to any extent, for the pelvic organs lose their natural support and are prone to fall. *Rectocele*, or prolapse

of the posterior wall of the vagina, and *cystocele*, or prolapse of the anterior wall of the vagina, are common consequences.

There is no reason to believe that such an accident is the fault of the accoucheur in all cases; it is in some, doubtless, but with a large child and a rapid labor, it is often difficult to prevent. I have known it occur in the practice of very good men.

Slight ruptures of the perinæum need not be regarded, but when a rupture into the body of the perinæum takes place during labor, and the accident is recognized, the best practice is to put in one or more sutures at once. One or two sutures introduced at the time is so sound a practice that it cannot be too confidently recommended.

When the present time has passed and the operation is postponed to the future, it must be till the period of suckling has passed, and the general health of the patient has been restored, for the operation being a plastic one requires good power on the part of the patient, and immediate union of the wound is wanted for success. It is, however, very successful when properly performed; indeed, it very rarely fails.

Operation.—Before the operation the bowels should be well cleared out; an aperient is to be given two days before, and an enema on the day of operation. Chloroform should be given, the patient placed in the position for lithotomy, and the buttocks brought to the edge of the table; an assistant should then well separate the labia. The surgeon may now with his scalpel map out the portion of integument that he proposes to remove, remembering that it is well to have a broad surface to bring together and

a cleanly cut one, for a thin membranous union is useless, and a jagged surface will not unite; at least, one inch of raw surface should be made, the width of the bared surface diminishing slightly towards the anterior portion of the labia. Having mapped the parts out for removal, the best plan is to perforate the tissues towards their centre and cut outwards, the right half being first treated and then the left (Fig. 278).

Not a remnant of the mucous membrane should be left.

Should bleeding occur the arteries may be twisted, and a little pressure soon controls the smaller vessels.

The second step of the operation remains to be performed, and it is of no less importance than the first. The sutures are to be introduced at least an inch from the margin of the wound, and the one nearest the rectum first. When

the recto-vaginal septum is involved the introduction of this suture is of primary importance. It should be passed through the left side of the wound on a level with the septum, through the tissues and the septum, and out at a corresponding point on the right side, being completely buried in its whole course, the object being to draw the septum well forward. A second and a third suture may then be introduced as indicated in the drawing.

A quill suture is probably the best form to use, and good gut or twisted silk the best material. (*Vide* Fig. 196.) A needle such as that seen in Fig.

FIG. 278.



278 is the one I now usually employ; it is curved on the flat, so as not to cut the recto-vaginal septum in its passage, and has an eye in its point to admit the double suture. The parts are to be pressed together firmly after their apposition, and several superficial sutures of silk may be introduced. Should the parts be tight and much spasm of the sphincter be present, a division of the superficial fibres of the muscle at its posterior margin may be performed. Some surgeons do this as a matter of course. I have only done it in exceptional cases.

After the operation is completed the fingers should be introduced into the vagina and rectum to assure the operator that the parts are in apposition, and when any blood has passed into the vagina the passage should be syringed. A morphia suppository may then be placed in the rectum to relieve pain and spasm, and to lock up the bowels.

The patient is then to be removed to bed with her legs tied together, and flexed upon the abdomen. The urine should be drawn off every six hours for the first three or four days, and the parts kept clean. Ice-milk and beef tea may be given for the first day, but meat and wine subsequently should the appetite allow. The patient may lie on one side should she prefer it. When the quill suture is used, the deep sutures should be removed on the third or fourth day, and the superficial on the seventh. When silk, wire, or gut sutures have been employed, they may be left for six or seven days; but after the fourth day they should be taken away, when suppuration in their track appears.

On withdrawing the quill sutures, great care should be observed not to separate the thighs or parts; indeed, for quite ten days or more after the operation this point should be observed.

After the first week the use of the catheter may be dispensed with, the patient making water on her hands and knees, and the parts subsequently being carefully sponged. Should any offensive vaginal discharge appear, the passage may be syringed out with a lotion of Condyl's fluid.

The bowels should be locked up for at least a fortnight by small doses of opium twice a day, and then relieved by enemata of oil and gruel; indeed, in some cases where union is thought to be feeble, it is well to keep them from acting for a longer period, care being always observed that no large indurated motion be allowed to pass—warm water and oily enemata being used.

With this attention good success generally follows, and women may have subsequent labors without any giving way of the parts. Where much prolapse of the posterior wall of the vagina coexists, a strip of mucous membrane running up the vagina from the anal end of the recto-vaginal septum may be cut off and the edges of the wound brought together. I have done this in many cases with an excellent result; indeed, in many cases of prolapse of the uterus following some slight rupture of perinæum, or even without, this operation is of great value.

In vaginal cystocele a like operation is of benefit, the removal of a piece of vaginal mucous membrane at its labial border being often followed by a good result. Indeed, I am tempted to think that many more of these cases of vaginal and uterine prolapse are to be greatly benefited by surgical treatment than the majority of practitioners believe; and that, in the future, surgical treatment will be more frequently demanded.

Vesico- and recto-vaginal fistulæ, or an unnatural communication between the bladder or rectum and the vagina, are usually the result of long and tedious labor, from sloughing of the tissues after too much pressure, although at times they may be caused by the rough use of instruments or the presence of a stone. They are as a rule, discovered a few days after

the delivery, by water, wind, or fæces passing through the vaginal passage, these symptoms appearing on the separation of the slough.

The surgeon is usually called upon to treat the case when the puerperal month has passed, and the patient's powers have been restored; till then it would be rash to think of interference.

The operation for the cure of these affections is a very good one, and as a rule is successful, failure following only in exceptional instances, when the subjects are feeble with small reparative power, or when the loss of tissues is too great to be made up.

Recto-vaginal fistulæ are more readily cured than vesico-vaginal. Both operations are alike in principle.

Operation.—Without going into its history, full details of which are to be found in the special works on the surgical diseases of women, it may be said that it is to Sims and Bozeman, in America, Simpson and Brown, in this country, that the modern operation has been brought to its present state of perfection, although it is probably due to the introduction of chloroform that its great success is to be attributed.

Very small fistulæ may probably be cured by the actual or galvanic cautery, but anything above the size of a crowquill demands some plastic operation.

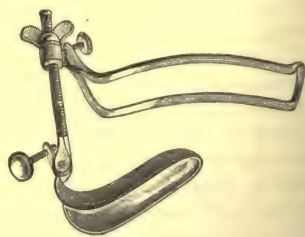
In the operation the surgeon has three main points to observe: 1st. To bring the fistula well into view and under control; 2d, to pare with nicety and accuracy the whole margin of the fistula; and, 3d, to bring into and maintain in apposition the raw and incised surfaces.

For the first object the duck-bill speculum is undoubtedly the best; by some authors it is known as Bozeman's, by others as Sims's. It is both a dilator of the vagina and a retractor. Some surgeons, Jobert being amongst them, talk of exposing the fistula by dragging the uterus externally, and thus everting the vagina. I have never had the boldness to use sufficient force to do this, and cannot advise it. Such a measure would, however, greatly facilitate the different steps of the operation.

FIG. 278 a.



FIG. 279.



Weiss has recently so arranged the duck-bill speculum as to be self-supporting (Fig. 279). I have used the instrument, and have been much struck with its value.

For recto-vaginal fistula the patient should be placed on her back, as in lithotomy, and for vesico-vaginal this position is at times the most convenient. I usually prefer the semi-prone position, the knees and thighs falling over the end of the table, the surgeon looking down upon the fistula (Fig. 278a). When the uterus is dragged down sufficiently far to evert the fistula, the lithotomy position is doubtless to be preferred.

The fistula having been brought well into view, the next step is to pare its edges, and in doing this the operator must not be too sparing of tissue. He must get as broad a surface as he can, and as clean a one. When this

can be secured by means of a knife and forceps, no better instruments are required; the best knife is one that can be adjusted to any angle with rapidity and ease. When the fistula is high up in the vagina, the pronged guide (a modification of Hilliard's, of Glasgow) made for me ten years ago, is an excellent instrument (Fig. 280); it is readily applied and insures a clean cut surface. Some surgeons prefer the scissors (Fig. 281).

FIG. 280.

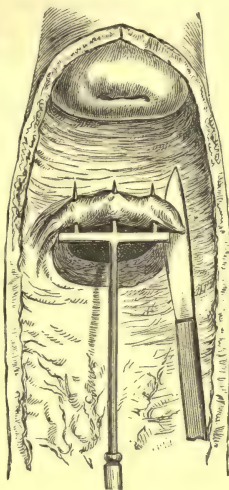


FIG. 281.

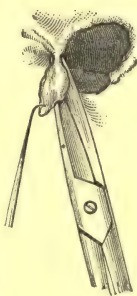
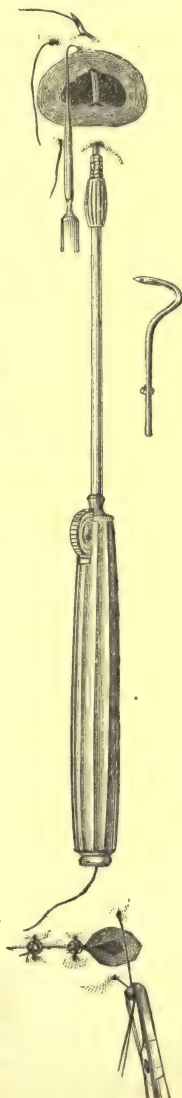


FIG. 282.



When this step of the operation has been completed, the edges of the fistula have to be brought together; for this purpose numerous devices have been employed. Splints of all kinds have been suggested, but with experience they have all been discarded, simple wire gut, or silk sutures, fastened with shot or otherwise, being preferred. I have tried every form of splint, and have at last come to gut sutures and shot fastenings, at times using a plaited fishing silk.

The sutures should be introduced tolerably close together, and at a good distance from the margin of the wound, say one third of an inch; they should not be drawn too tight. They should be fastened by running a perforated shot down over them, taking the precaution subsequently to tie the gut over the shot to prevent its giving way. In this step the operation is similar to that for fissured palate. In Fig. 282, the needles employed, with the mode of introducing and securing the sutures, may be seen.

A good strong pair of forceps are required to nip the shot after they have been slipped into position.

When wire or gut are employed, Startin's hollow needles may be used, but the ordinary curved needles with good eyes at their ends are the best for silk. With wire, gut, or silk, the shot fastenings are the best.

After the operation the vagina should be well cleansed of blood, and the bladder emptied. Ice or iced water will generally arrest any bleeding that may occur. An opiate suppository should be administered after the opera-

tion to give ease, and the same practice followed as to the bladder and diet as after the operation for ruptured perinæum.

To leave a catheter in the bladder after the operation for vesico-vaginal fistula often adds to the irritation; its careful introduction at stated periods is preferable. When from circumstances this cannot be attended to, the introduction of a short catheter, with an open end to allow of the urine passing as it is secreted, should be employed. Dr. Meadows allows his patients to pass their own urine after the operation, and I have done this in some cases without any bad result.

On the sixth or seventh day the sutures may be removed; at times when they are not causing irritation they may be left in position for a longer period, if good union has not taken place.

During the convalescence the vagina should be kept well cleansed by water, or some lotion containing Condyl's fluid.

In recto-vaginal fistula the bowels should be kept locked up for ten days or a fortnight, till good union has taken place, and then the feces should be rendered soft by enemata of oil and gruel.

When the tissues around the edges of the fistula are too thin to allow of their being pared, or, indeed, under other circumstances, they may be split; that is, the vaginal mucous membrane may be raised from its submucous bed for half or three-quarters of an inch round the fistula, and the under surfaces of the raised membrane brought together and held there by a quill suture. I have adopted this method on some half dozen occasions with good success, and am most favorably impressed with its advantages. I was led to do so some years ago in a case of vesico-vaginal fistula where there was no tissue to spare, and was pleased subsequently to see so good a surgeon as the late Mr. Collis, of Dublin, make the same suggestion independently. Dr. Kidd and Mr. Mapother, of Dublin, have however adopted what appears to be a better practice. They make a U-shaped cut round the fistula through the mucous membrane of the vagina, raise the flap thus formed, and cut off its lower half, including the opening of the fistula in the vaginal mucous membrane. They then draw down the shortened flap over the fistulous opening into the bladder and unite it by sutures to the crescentic border of the mucous membrane forming the bed from which the flap had been raised. The fistulous opening into the bladder is thus covered over with a flap of sound mucous membrane. ("Brit. Med. Journ.," June, 1872.) When this plan is adopted, the sutures must be removed on the fourth day, otherwise the pressure of the bougie may cause ulceration. At times it is best only to cut the sutures, and leave the quills in position for a day or so longer, but the amount of irritation they cause must be the surgeon's guide.

When the neck of the uterus is involved in the fistula, it may be necessary to lay it open; but when the uterus is involved, it is more frequently necessary to turn the neck of the uterus into the bladder and close the vagina high up. In very extensive lacerations of the vesico-vaginal septum, the surgeon may be called upon to close the vagina nearer its orifice. I have done so on two occasions with good success, two or more operations being required.

When the fistula is surrounded by cicatricial tissue, and when after the adaptation of its edges there is much tension, an incision or two through the parts is a wise step; it allows the edges to come together more readily, and thus facilitates repair.

In recto-vaginal fistula, before an operation is attempted, the surgeon should satisfy himself that no stricture or disease of the rectum coexists,

and to which the fistula is secondary. This can readily be done by digital examination of the rectum.

Vascular excrescences are very common in the female urethra, and from their great sensibility they cause severe pain; they at times project from the meatus as a florid outgrowth; they are often attended with a discharge of mucus, and at times of blood, also with irritability of the bladder.

Their removal is the only sound treatment, and this is the best effected by forceps and scissors. The growth being well drawn downwards and excised, a stick of nitrate of silver may be applied to the base of the tumor to prevent bleeding; and when any doubt exists as to its complete removal, some chloride of zinc.

When the urethra is the seat of more than one such growth, the introduction of a stick of sulphate of zinc at intervals of two or three days, may be followed by their withering; but when this result does not ensue, the passage must be dilated and the growths removed. Nitric acid in some cases is a good caustic to insure their destruction when excision or the galvanic cautery cannot be employed.

Polypi of the female bladder may protrude through the urethra, and put on the appearances of a urethral growth; a complete examination, however, of the urinary organs will prevent the surgeon falling into any error of treatment.

Fibro-cellular tumors at times grow in the urethra and cause much local distress. I removed one from a lady two years ago, with a good result; this occupied the whole floor of the urethra to the neck of the bladder.

Irritable bladder in women is a very common effect of uterine disturbance or displacement, as well as of rectal disease. Such a symptom demands the closest investigation to find out its cause; it has mostly a secondary cause, and not a local one.

CHAPTER LXI.

ON OVARIAN DISEASE AND OVARIOTOMY.

OVARIAN disease is a somewhat common affection; it is occasionally composed of one large cyst, but more commonly it is polycystic or semi-solid. It is found at all ages, a rare preparation at Prague showing a cyst in the ovary of a child a year old. I have recorded two cases in which girls aged respectively fifteen and sixteen sank after tapping from suppuration of the cyst; and in 1869 I published in the "Guy's Reports" a case of ovariectomy successfully performed in a child aged fourteen, in whom no signs of puberty existed; the tumor was polycystic. The majority of cases, however, occur during the active period of ovarian life. I cannot, however, in this work enlarge upon the pathology of these tumors, although I may refer the reader to a paper by Dr. Wilson Fox ("Med.-Chir. Trans.," vol. xlvii), in which all necessary information upon the subject will be found, with references.

The following conclusions, taken from a careful examination of the records of 88 fatal cases of ovarian disease, extracted by Dr. Phillips from "Guy's Records," and copied from my work "On Ovariectomy," published in

1867, give, however, these points in a condensed way, and are in their way conclusive.

Conclusions, *drawn from an analysis of 88 fatal cases of ovarian disease :*

1. That 9 per cent. of the ovarian tumors are apparently monocystic; 9 per cent. dermoid; 18 per cent. cancerous, and the remaining 64 per cent. polycystic or compound.

2. That 53 per cent. of the cases are on the left side, 29 per cent. on the right, and only 17 per cent. double.

3. That simple cystic disease of the ovary is rarely double, and that, when double ovarian disease exists, the majority of the cases are cancerous, colloid, or of the solid kind.

4. That about 70 per cent. of the cases are in married women, and that the disease is most frequent between the age of twenty and forty, or during the vigor of sexual life.

5. That the disease runs its course, in at least 75 per cent. of all cases, within two years, 30 per cent. dying from exhaustion, 20 per cent. from peritonitis, 17 per cent. from suppuration of the cyst, chiefly following tapping, 9 per cent. from the two last causes combined, 10 per cent. from peritonitis caused by rupture of the cyst, 10 per cent. from the cyst ulcerating into some viscus, such as the intestine or bladder, and hemorrhage into the abdomen and strangulation of the bowels by the pedicle causing death in 1 case in the 100.

6. That in the *monocystic* tumors there is a greater disposition for the cyst to ulcerate into the bowels than in other cases, and to suppurate after tapping.

7. That in 56 per cent. of the cases of cancerous disease, both organs are involved.

8. That in the dermoid tumors there is a greater disposition for the cyst to rupture than in all the other forms of disease, death being directly due to this cause in 37 per cent.

9. That acute peritonitis and suppuration of the cyst as a direct result of the operation of tapping is by no means unfrequent.

In the treatment of ovarian disease medicine is of little value; it has no influence in arresting its progress in a direct way; it does good only by improving the general condition of the subject. Injecting the cyst is only applicable to a small class of cases. Ovariectomy, in a general way, is the only radical cure.

At the present day the operation is an accepted one by the profession; it is as recognized and as justifiable as any other grave operation, and surgeons and physicians differ only as to the class of cases in which it is applicable, and the period at which it should be performed.

British surgeons may probably claim the credit of having established this fact, in spite of early difficulties and blind opposition, and the names of Lizars, of Edinburgh, MacDowell, of Kentucky, Jefferson, of Framlingham, Walne, Fred. Bird, Lane, Morgan, Aston Key, Cooper, and Caesar Hawkins, of London, must ever be remembered as amongst its earliest practical promoters.

Charles Clay, of Manchester, however, the first great ovariectomist in this country, Brown, and particularly Spencer Wells, of London, Keith, of Glasgow, Koeberle, of Strasburg, Sköldbeg, of Stockholm, and Atlee, of America, with Hutchinson, and possibly the present writer, have by their successes fairly overcome all prejudices, and rendered the operation an established and an accepted one, for without going into the details of statistics, which are now no more needed in this than in other large operations, it may be confidently asserted that the operation is not placed in too favorable a light

when it is said to be successful in 2 out of every 3 cases, good, bad, and indifferent, and in at least 3 out of 4 selected cases; at least, this has been my average in 60 cases.

Mr. Spencer Wells tells us as the result of his unrivalled experience, that out of his 400 cases, 107 died, and of his last 100 only 22. He ventures also to express his conviction that the mortality may be reduced to 15 or perhaps 10 per cent., without excluding those extreme cases in which the operation is performed as a forlorn hope. ("Med.-Chir. Trans.," vol. liv.)

Having decided that the operation of ovariectomy is justifiable under some circumstances, and desirable under others, it will be well to consider what those circumstances are, under which it should be undertaken, and what cases are the best adapted for its successful practice.

Are all examples of ovarian disease to be treated by extirpation?—if not, which are to be selected and, at what period of the progress of the disease should the operation be performed?

What cases are to be selected for operation?—The very statement of this question would seem to imply that the operation of ovariectomy is not suitable in all cases of ovarian disease, and that there are some to which it is quite inapplicable—for choice implies selection, and, as a consequence, variety—and this leads us to consider what are the different forms of ovarian disease? For surgical purposes, it is sufficient to divide all cases into the *simple* cysts, and the *compound*,—the former composed only of one cavity, the latter of many—solid material being almost always present, though varying in amount.

In the simple or *monocystic* ovarian tumors, when the diagnosis is clear, there are, doubtless, other plans of treatment open to the surgeon than ovariectomy; and amongst these, the treatment by injection of iodine stands foremost. In the hands of different men it has had variable success. M. Boinet tells us that out of forty-five patients suffering from this disease thirty-one were cured, five had relapses, and nine died; Sir J. Simpson performed it in about twenty cases with good success, one case only dying; and Dr. Tyler Smith tells us that out of ten cases in which this practice was followed two only were satisfactory, and two died. Dr. West had one cure in eight cases.

Still, this plan of treatment does not generally meet with much favor, for it is uncertain. In exceptional cases it may cure, but in the majority it does no good, and may even be followed by a fatal result: relapses after its employment appear to be very frequent, and in this element of uncertainty lies its greatest fault. It is only applicable also to the simple cases of monocystic disease; it is quite inapplicable and useless in the multilocular tumor, and where solid growth exists; and here the diagnosis between the two forms of disease comes under consideration, a question undoubtedly of some difficulty.

A simple ovarian cyst, uncomplicated with the development of smaller cysts within its walls, and unassociated with any solid growth, is unquestionably a somewhat rare affection. Such cysts are occasionally found—examples have fallen under my own observation—but they are not common; the majority of the cysts, even those which appear to be simple, possess the remarkable power of reproducing other cysts within their walls, being, as Sir J. Paget originally described them, *proliferous* cysts; and, during life, it may be stated to be an impossibility to form an accurate diagnosis in most cases between the two varieties.

Amongst the cases which have been tabulated as monocystic tumors—only nine per cent. of the whole number—no doubt many were of the *proliferous* kind, and in these the treatment by injection is not to be advised.

Still, to the surgeon's mind, the treatment by iodine injection should always be entertained in every case of apparent monocystic ovarian disease, while the circumstances of each individual case can alone determine what course is to be taken.

Of the *fibrous* or *solid* tumors of the ovary little need be said; they seldom develop to any size, or interfere with the patient's comfort to any great extent, and the expediency of their removal has rarely to be entertained by the surgeon. Should they, however, by their size become cumbersome, the expediency of their removal must be entertained, and decided upon as in other cases.

In all other forms of ovarian disease, in the *multilocular* or *polycystic*, composite, adenoid or cysto-sarcomatous, as they have been variously called; in all those, in fact, which are made up of many cysts, and of a variable quantity of solid material—these cases forming the bulk of those coming under observation—there is no treatment which appears to be of any material benefit, none which seems to have any influence in retarding the growth of the disease, in palliating its inconveniences, or averting its end. The treatment by iodine injection is obviously inapplicable, and there is nothing else which offers any prospect of doing permanent good; the patient must quietly submit to her fate, or to the alternative of an operation; and in these cases, bearing "the stamp of incurability upon them," the question becomes necessarily narrowed.

By means of the operation of tapping, a patient may obtain relief, but it is only temporary; within a brief period, and at uncertain intervals, the operation will have to be repeated, and by repetition of such means existence may be prolonged, but in the majority of cases this prolonged existence is a miserable one, and the intervals of so-called ease are, at the best, uncertain. Tapping is also at times a fatal operation, in rare instances from hemorrhage into the abdomen, but more frequently from acute peritonitis and suppuration of the cyst. My own statistics prove that these causes of death are 35.5 per cent. more frequent when tapping has been employed than when the disease has been allowed to run its course.

It is to be observed, also, that in all cases of tapping, parietal adhesions, if not visceral, are almost certain to take place, and in the analysis of fatal cases this fact is well demonstrated. Under these circumstances, is the operation of tapping to be recommended in such cases of ovarian disease as appear to be favorable examples for the operation of ovariectomy? Without doubt, in the majority of cases such an operation had better not be performed. For *diagnostic* purposes it may be employed with confidence and with good effect, for it is better to run the risk of causing the formation of adhesions, and even of death, by the operation of tapping, than to submit a patient to the dangers of ovariectomy, when the nature of the case is not clearly understood, and the propriety of the removal of the growth is surrounded with doubt. In very chronic cases it may also be adopted when the tumor is made up of one large cyst; but under other circumstances, it is by no means advisable to have recourse to the practice. Mr. Spencer Wells, however, assures us that the mortality of ovariectomy is but little affected by tapping.

When a patient has attained the point at which it is evident something must be done for her relief—when the diagnosis of the disease is clear, and there are no points in the case which contraindicate the capital operation of ovariectomy,—it is by far the safer practice to operate at once than to lose time, which may be of value, or to risk causing the formation of adhesions, which are always evils, by any such temporizing means as that of tapping. For diagnostic purposes, the operation of paracentesis abdominis

is one of great value in certain cases, as it is in others in which relief is a necessity, and the operation of ovariectomy is inexpedient or inapplicable; but under other circumstances, tapping is a mistake, and should be avoided.

Are all cases, therefore, of polycystic tumors of the ovary to be excised; and, if not, which should be rejected? It has been already shown that there is no hope of doing permanent good to any patient laboring under this disease by any special treatment, for there is no remedy which can be trusted to retard the growth of the tumor, or to arrest its progress. Further there is no operation, less than that of extirpation, which offers any prospect of affording permanent relief,—none which can be looked to with any hope of benefit. Still, there are forms of multilocular ovarian disease which it would be unwise, others with which it would be quite unjustifiable, to touch, and amongst them the cancerous tumors stand pre-eminent. It is true, there is great difficulty in forming an opinion upon this point, upon making a diagnosis as to the existence of such a cancerous growth. Still, an approach to certainty may be made, a fair probability can be attained. It is not, however, to be made out by any local examination alone; as far as my own experience goes, there are no definite local symptoms by which a solid or semi-solid multilocular cancerous ovarian tumor can be diagnosed from a solid or semi-solid multilocular benign one. As a rule, in their chief local features these forms are not to be distinguished, although, perhaps, in rare examples of cancerous disease the general outlines of the growth are more irregular or nodular. The suspicion of its cancerous nature is only to be roused by the general condition of the patient, and the natural history of the case; in the cancerous there will be, as a rule, more emaciation, more wasting and rapid constitutional decay than in the benign. The disease will, as a rule, run its course more rapidly, although the size of the tumor will seldom be so great as in the simple cystic form. Still, this rule has many exceptions, for the cancerous tumor of the ovary is very commonly a cystic disease, and there are no reasons why these cysts should not enlarge as much in the malignant form as in the simple; in practice this is found to be the case. When solid, however, and uncomplicated with cysts, the cancerous tumors rarely attain a great size. It has been said that the œdema of the abdominal walls may be looked upon as a useful guide to indicate the cancerous nature of ovarian disease, but my own personal experience tends to prove that such is not the case; for in those instances which have come under my observation in which this symptom has existed to the greatest extent, and to the most marked degree, there has been little doubt as to the benign nature of the disease, for the tumors had all been of many years' duration; one, indeed, of eight, another of twelve, and another of at least thirty years. In these three extreme examples the thickness of the œdematous integument over the lower part of the abdomen might have been calculated by inches, and the œdema of the skin showed itself in vesicular swellings, varying from that of a pea to a large grape. In all these cases tapping in the median line of the abdomen, or, indeed, in front, was out of the question, and a lateral position had to be selected. A pelvic examination may be of value in these examples, and if the organs are found to be somewhat fixed and immovable, instead of being free and mobile, the probability of the growth being of a cancerous nature is much increased, for the disposition to cause infiltration of the neighboring parts is as common in cancer of the ovary as it is in cancerous affections of other parts. There is another point also which deserves notice, and that is the disposition there is in cancer of the ovary for the disease to involve both organs: out of my notes of fourteen examples of disease of both ovaries, nine were cancerous; and among the cancerous

cases there were only seven examples, or forty-three per cent., in which the disease was single—the law of symmetry being observed in this as in other forms of constitutional disease. Under such circumstances a careful pelvic examination is a matter of great importance, and under no conditions should it be omitted, for by such means alone are these points to be made out in a large proportion of cases.

Are all Cases of Benign Multilocular Ovarian Tumors then to be Excised?—There is no doubt as to the answer which must be given to this question, for by no other means than the extirpation of the growth can a woman be relieved of such an organic disease. The patient must be left alone to bear the inconvenience of the ovarian tumor, to endure the living death of its matured miseries, and to die, worn out and exhausted by the prolonged sufferings produced by its presence; or she must run the risk of the capital operation at one time or other in the progress of the disease, and submit to ovariectomy.

Before, however, we proceed to consider at what period of the tumor's growth it is desirable to undertake its extirpation, it will be well to look back to the natural history of the disease, and inquire, what are the chances of life for a patient who is left alone?—how long may life be prolonged under favorable circumstances?—what is the average period in which ovarian disease runs its course?

It is needless to quote numerous authorities in discussing these points, for all men are tolerably agreed that the average duration of life of those who are the subjects of ovarian tumors, when the disease is allowed to run its course, is two or, at the utmost, three years; that few live over four, and that those who survive beyond that period must be looked upon as exceptional instances. In my own cases 75 per cent. ran their course within two years.

“Taking everything into consideration,” says Dr. Graily Hewitt, in his admirable work on the diseases of women, “we shall not be far wrong in drawing from the published cases of Dr. Lee and Mr. Stafford Lee the conclusion that the probable duration of a case of ovarian disease of progressive character is, in 85 or 90 per cent. of the cases, two, or at the most three years; of the apparently ‘stationary,’ or chronic cases, the progress is more favorable, but in such cases the disease is liable at any moment to start into fresh activity. The first question we naturally put to ourselves when a case of the kind comes before us for decision is, Does this case belong to the fortunate series, the 10 or 15 in the 100? or is it one of the 90 who must die in the course of two or three years if unrelieved?” To the surgeon, however, this question is not of so much importance, for it is not till the tumor has become by its growth so large as to raise the question of operative interference that the answer has to be given, and at such a stage of the disease this becomes of little value.

Having clear ideas, consequently, on this important point, we may ask ourselves at what period of the tumor's growth should the operation of ovariectomy be entertained? And with all deference, I do not believe it difficult to answer this question, for it certainly should not be entertained when the tumor remains small, and is causing little or no mechanical inconvenience, and under these circumstances no surgeon would be justified in submitting a patient to this operation who may be in sound health, well able to perform all the duties of life, and enjoy fairly its pleasures.

Ovariectomy should not be thought of when the patient's general condition of health is very bad or the powers feeble; when there is any evidence of disease in any other organ than the ovary; when, indeed, it is tolerably evident that the powers of life are unable to withstand the shock of the

operation, and seem incapable of rendering the needful reparative assistance for the recovery of the case.

It is no more to be entertained, under these circumstances, than would any other capital operation; the same principles which guide the surgeon in the ordinary conduct of his professional career are of course applicable when the subject of ovarian disease is under consideration, and should be scrupulously adhered to in the practice of all operations.

It is true that a surgeon is sometimes led to perform an operation in almost desperate cases, when suffering is severe, and death is certain if the patient be left alone, although the probability of saving life is almost *nil*, such as in neglected hernia, in certain examples of amputation for disease or accident, in the ligation of a vessel or the excision of a tumor. Still, it is in exceptional examples of disease or injury that such operations are performed, and when there is a possibility of success being obtained by an operation, and none without. Under like circumstances, a surgeon may be called upon to perform ovariectomy; when a patient is evidently being worn out by the disease, and by it alone; when life's tortures are not worth prolonging, and death can be calmly looked at and even wished for; when there is even a bare possibility that, on the removal of the local disease which is clearly destroying life, the powers of the patient may rally, and that at any rate relief to suffering will be secured; under such conditions, an operation may be admissible. With the aid of chloroform the operation is rendered painless, and it is certainly true that the after pains are, as a rule, marvellously little, for I have heard patients frequently say that the pains after the operation are rarely so severe as the pains before. Under certain circumstances, consequently, the surgeon may be justified in performing ovariectomy with the object of giving relief, when only a scientific possibility exists of doing more, in the same way that he may be justified in doing any other operation, with the same object and a like slender hope.

When evidence exists, or even a suspicion exists, that the condition of the patient is due to some disorganizing change in the cyst itself, or some suppuration, the operation should be hastened; to wait is to allow the patient to die, for any improvement in the general condition is impossible as long as the local cause of the symptoms remains. The existence of an inflamed or suppurating ovarian cyst ought to be an argument for the surgeon to operate rather than the reverse. This condition is to be suspected when fixed local pain and tenderness, constitutional disturbance, fever, a quick pulse, and a permanently high temperature exist; when, in fact, the general condition of the patient is such as to satisfy the surgeon some local source of irritation exists.

We have hitherto briefly explained when the operation is not to be undertaken, and shown when it may perhaps be justifiable in extreme cases, but the surgeon should watch himself carefully in such desperate cases, and not be led to undertake them without much anxious thought and earnest consideration, for operations undertaken with no reasonable prospect of success, are palpably unjustifiable, unscientific, and inhumane—they degrade the surgeon and injure the profession. The public derive no benefit from the experiment, and the character of operative surgery necessarily suffers, for it is well to bear in mind the sarcasm of Cruveilhier, that “even success does not always justify rash enterprises.”

Let us, however, return again to our original point, and inquire into the circumstances under which the operation of ovariectomy should be undertaken in the majority of cases, and after what has been written the answer to this question can hardly be regarded as a difficult one. For if the reasons

already given for the rejection of the operation are to be regarded as correct, it is tolerably clear that it is to be thought of only when the tumor has, by its size, become cumbersome, interfering with the comfort and curtailing the powers of the patient to perform the duties and enjoy the pleasures of her ordinary existence; when it is beginning to interfere with the natural functions of the frame, and impair the efficiency of the patient's powers; when the general health is becoming affected, and the local effects of the disease distressing; under these circumstances, and under these alone, the question of operation is to be considered, and, if permissible, it is to be undertaken.

On the Operation of Ovariectomy.—Before we pass on to the consideration of the operation of ovariectomy, it may be well to inquire into the necessity of adopting any special treatment in the preliminary preparation of a patient who is about to pass through such an ordeal; for some authors have led us to believe that in this point of practice there is some special power, and that success or non-success in the ultimate result of this operation, may be determined by the care with which the preliminary treatment has been carried out. For my own part, I must confess that I have failed to recognize the necessity of adopting any such line of practice. The principles by which we should be guided in the preliminary treatment of a patient about to undergo the operation of ovariectomy need not differ in any way from those which experience has taught us to be called for previous to any other capital operation. We should do our best to raise the standard of health by all those general hygienic and tonic influences which are well known to act beneficially towards the attainment of that end, such as good air, simple, nutritious diet, a fair amount of stimulants, and the administration of some tonic. Let the patient take exercise when she can without pain, but take care that it is kept within the limits of fatigue, that it is on level ground, and that no shaking or straining be on any account allowed; and when she is at rest let the half-reclining position be the one usually assumed. For a day or so before the operation, however, exercise, even when possible, is not to be advised, for quiet and repose are doubtless then of some essential service.

As a tonic medicine, iron appears to be of real and important value; it seems to have an influence for good which other tonics do not possess. It is no more useful, however, before the operation of ovariectomy than it is before any other capital operation, but it is as good. I have often thought that in hospital practice wounds are less prone to inflame, and that erysipelatous affections are less common under the influence of this medicine than when no such preliminary remedy had been administered. In peritoneal operations this point is of primary importance, and, as a consequence, the adoption of this practice is one to be recommended. The form of iron I prefer is the tincture of the perchloride, twenty drops of which, combined with a like quantity of chloric ether, or of syrup of lemons, in water, form a pleasant draught.

The bowels of the patient should be gently opened two days previously by a mild aperient, such as castor oil, or the saline rhubarb powder of the Guy's pharmacopœia, and on the morning of operation the large intestine should be washed out with a warm water enema, but nothing like powerful purgation should be allowed under any consideration. Care should also be observed that the catamenial period has passed for at least a week previous to the operation, for all ovarian excitement is necessarily injurious at such a time, and should be avoided. I have known cases of ovariectomy being undertaken without any consideration of this point, and believe that an untoward result is to be expected under such circumstances.

In hospital practice the patient should be isolated as much as possible from all others, and a private room, if possible, obtained, in which good ventilation exists; a special nurse should also be secured, who is not only entirely trustworthy, but who understands how to use a female catheter without fumbling. In private practice the patient's own house is the best place for the operation to be performed, and country patients should not be brought into town unless an urgent necessity exists; for there is little doubt that the air of a large city is not so conducive to the rapid reparation of a wound as fresh country air. In abdominal surgery this influence for good is of great value, and should not be thrown away unless from necessity.

The surgeon who is to operate, and his assistant, should not allow themselves, for a few days before the operation, to visit the post-mortem or dissecting-room, nor should they handle any morbid preparations. Erysipelatous affections and all contagious diseases should also be shunned as much as possible; indeed, the same rules which are observed by the careful obstetric practitioner are applicable to the surgeon who undertakes the operation of ovariotomy; for the same subtle poisons which are recognized by all to be hurtful to the puerperal woman, act with equal force upon the subject of ovarian disease, when submitted to ovariotomy, and, as a consequence, should be conscientiously avoided.

It follows, therefore, that, as regards the lookers-on at an operation, and all who may come into contact with the patient, none who may bring infectious or contagious disease to the bedside should be on any account admitted. The physician who is attending a case of puerperal fever, is looked upon as a possible poisoner, as far as concerns the puerperal woman. The medical attendant of a scarlet fever case, of erysipelas, or of other contagious disease, should be regarded in the same light in the presence of an ovariotomy operation, and should be excluded. Hence it is, that in hospital practice, great care is needed to exclude all such possible means of injury as I have just briefly enumerated.

The surgeon and his assistant should strenuously observe the rules I have just laid down. The operator should admit into the operating-room only such senior men as have, as it were, subjected themselves to the required quarantine rules to which I have alluded, and the spectators who come from without the hospital walls should be closely questioned as to their freedom from contagious influence. He should not only be sure that he is himself free from all possible sources of evil contagion or infection, but he should take care that all who come in contact with, or within the sphere of influence of his patient, are declared clear from morbid material.

I need hardly allude to the necessity of all bed and bedding, blankets, sheets, and hangings being perfectly fresh; that all sponges should be *new*, soft, well cleansed and scalded, free from soap and all grit; that flannel, when wanted, should be fresh, having been previously well washed in warm water; and that every instrument employed should be scrupulously clean. The hands of the operator should be thoroughly cleansed from soap just previous to the operation, and should be well warmed, for manipulation with a cold hand cannot but prove injurious to an exposed peritoneum. In Dr. Peaslee's mind this fear of irritation from the handling of the intestines and peritoneal membrane is so great that he bathes his hands with a preparation which he calls an artificial serum, composed of water four pints, white of egg six drachms, and salt four drachms. This practice has not, however, been followed by any other operator.

The Temperature of the Room in which the Operation is Performed.—There is still some difference of opinion upon this point, between operating

surgeons, Dr. Clay, of Manchester, Peaslee, of America, and others, advising that the operating-room be heated to 75° F. or 80° F., and a good supply of moisture engendered by the diffusion of steam. Other surgeons make no such rule. And speaking from my own experience I have no faith in the adoption of such a practice. I would have the room heated to a comfortable temperature; that of 65 degrees is amply sufficient. A greater heat acts as a powerful depressant upon the patient, and can do no good. A warm room with good ventilation is what I have always striven for, in preference to a hot one with closeness. A cold damp room is unquestionably to be condemned.

The Position of the Patient.—The horizontal position is one that patients suffering from ovarian disease can rarely assume, and when the tumor is so large as to require ovariectomy, it becomes almost an impossibility. As a consequence, the half-reclining position is the most comfortable for the patient who is about to undergo ovariectomy, and it is quite as convenient for the operating surgeon. It is the posture I have invariably adopted in the cases which have fallen into my hands, and I know of no good reason why it should be altered. Some operators have employed the sitting posture in preference to any other on account of the facility with which the tumor can be removed through the abdominal incision, and also on account of the advantages it gives in preventing the escape of the ovarian cyst-contents into the abdominal cavity. For the same reason Mr. Hutchinson prefers the patient to be turned partially on her side, but both these postures are not only inconvenient to the operator, but have other real objections which forbid their recommendation. The chief objection rests, however, on the fact that the same law of gravity which acts upon the tumor and its contents, facilitating its escape from the abdominal cavity, and allowing it to tumble out when the incision is made, acts as powerfully upon the abdominal viscera, and thus the disposition which always exists for the intestines to escape through the abdominal section is greatly increased, and the danger of excess of manipulation of these parts is much aggravated; the difficulties of the operation are also increased. The tumor may fall out, also, too rapidly, and, by causing a too sudden and unexpected strain upon the pedicle, a severe and perhaps fatal rupture of some important part may take place. This evil is no slight one, and, as an argument against the practice, is of some force. Upon the whole, the advantages said to be gained by the side posture are thus counterbalanced, and, as I think, more than counterbalanced by disadvantages.

The half-sitting or semi-recumbent position affords all the advantages which have been claimed for the others to which I have alluded, without their evils; for in it the tumor can readily be removed from the abdominal cavity, and, with care, its fluid contents can, without difficulty, be prevented from passing into the peritoneal cavity. There is, also, abundant room for every manipulative act that can be called for.

The Administration of Anæsthetics in the Operation and Local Anæsthesia.—Amongst the many incidental advantages which the introduction of chloroform has afforded beyond that of relieving pain, there are few greater than that of obviating all hurry, a point of critical importance in ovariectomy, for there can be little doubt that the success of the operation has thus been greatly influenced by the use of this anæsthetic.

It is true that operations for the removal of an ovarian tumor were undertaken before the introduction of any anæsthetic, but we all know how fatal were their results, and how exceptional was a recovery. Those who had an opportunity of witnessing the performance of an operation under such unfavorable circumstances, can hardly wonder that so many examples

succumbed to the practice, although they might be surprised that any were found to convalesce. To see a patient writhing under the agonies of an abdominal section was enough to make the hardest heart turn with horror, and to witness the surgeon's hands within the abdomen of a struggling woman, in his endeavor to remove an adherent growth, was almost sufficient to make any professional spectator decide that such an operation was really unjustifiable.

How was it possible for a surgeon to be quiet in all his movements, gentle in his manipulations, and thoughtful over the difficulties which, of necessity, present themselves in an ovarian operation, when the cries of the patient's agony stimulated him to expedition, and her struggles forbade gentleness? All surgeons who have operated upon these cases will agree that success, even under favorable circumstances, is only to be acquired by attention to these points; that hurry in any operation is always bad and unjustifiable, but that in ovariectomy it is destructive; that force is never to be employed in any case where art will answer; and in ovariectomy all blind force and dragging is to be strongly condemned; and that in a proceeding in which steadiness in operating, gentleness of manipulation, and thoughtful attention to every detail are absolutely essential to success, the safety of the patient must depend upon her quietness and passiveness under the surgeon's treatment.

Under these circumstances the value of some anæsthetic cannot be too highly praised, for the patient is by it not only rendered insensible to pain, but her perfect quiescence is guaranteed, and her passiveness under the hands of the operating surgeon completely insured.

The vomiting that occasionally follows the use of an anæsthetic is the only argument against its use, but it is an evil which must be endured for a positive good. In the use of the chloroform mixture, of alcohol one part, chloroform two, and ether three parts, as recommended by the Chloroform Committee of the Med.-Chir. Society, this vomiting is certainly less common than it is after the use of chloroform alone, and as a general anæsthetic it should be employed. Keith prefers ether and Wells the bichloride of methylene for the same reason.

Extent of the Incision into the Abdominal Parietes.—The temperature of the room, the position of the patient, and the propriety of the administration of chloroform, having received our attention, the operation itself next claims consideration, and the first thought naturally refers to the extent of abdominal incision that is required, for there is still a want of unanimity in the practice of different surgeons upon this point.

Before commencing, however, the careful surgeon will see that the bladder has been emptied by means of a catheter; that the linen of the patient has been well drawn up out of harm's way, and free from the chance of becoming soiled; that the limbs of the patient are well protected and kept warm by a pair of drawers, and covered by a clean sheet, either with or without a blanket. He will see that all his assistants are carefully arranged, with special duties assigned to each, and every instrument that may be required nigh at hand.

The surgeon may then proceed to make his incision, the patient having been brought completely under the influence of chloroform; but, beforehand, he has to determine as to its length. On reference to the results of the practice of different operators, it may with confidence be asserted that it is not of much importance whether the abdominal incision be a long or a short one. From Mr. Walne's, Sir J. Simpson's, and Dr. Clay's practice, it might be argued that the long incision should always be adopted, for their success has been great, and in their practice the long incision has been

invariably employed. From the practice of Dr. Keith, Mr. Spencer Wells, and others, the short incision would appear to be the best, for their success has at least been as good as that of Dr. Clay and others, and as a rule the short incision has been the one selected. But I take it the truth lies between the two extremes.

When the tumor can be removed with facility by means of a short incision, a long one is clearly not required, and when the tumor is monoecystic, or nearly so, and free from abdominal adhesions, it may be so removed. But when the tumor is large and semisolid, or when adhesions exist which cannot be readily broken down by the employment of gentle traction upon the growth, it is, doubtless, the best practice to make a long incision; for by so doing the removal of the growth is much facilitated, the causes of its abdominal retention, and the connection of the adhesions, are satisfactorily ascertained, and as a consequence can be dealt with with greater safety.

My own practice has been hitherto influenced by such a conviction; for I have in all cases commenced the operation by making a short abdominal incision, and, in many, have been enabled to remove the tumor without further trouble. But in certain examples in which difficulties appeared, and in which it was clear that adhesions existed—for the breaking down of which some force would have been required, and some working in the dark called for—I have been induced to increase the length of the wound upwards, even for an inch or two beyond the umbilicus, regarding such an increase of the incision as unimportant in comparison with the evil effects of violence, and dragging upon the tumor for the purpose of its removal, or the blind tearing down of the abdominal or visceral adhesions which have detained the growth.

I have never seen any evil effects from the long incision when made under the circumstances I have just indicated, but have, without doubt, seen the bad results of an opposite practice—of violence which has been employed in an attempt to remove a large growth through a small opening, or to tear an adherent one from its abdominal or visceral connections.

The incision should also always be made sufficiently low; if too high, considerable traction upon the pedicle of the tumor must be made to bring it into sight, and, with the tumor, the uterus will also be drawn out. This traction is always injurious, and is to be avoided. When the lower end of the wound is too high up, this traction of the parts becomes unavoidable; by extending the incision downwards towards the pubes to a point corresponding to the upper part of the healthy uterus, or about one inch above the pubes, this evil can be prevented, and, consequently, the practice I have just advised should invariably be adopted.

On Adhesions and their Treatment.—When the incision through the abdominal walls has been made, and the ovarian cyst is seen to be movable within the abdomen, and free from parietal adhesions, there is little difficulty in readily making out its visceral peritoneal covering by its smooth glistening surface; and by a glance of this the surgeon may become perfectly satisfied that the abdominal cavity has been fairly opened and the tumor exposed. It is also pleasing for the surgeon to observe, on the completion of his abdominal incision, that the tumor moves freely within the abdomen on each respiratory act, for when this symptom exists there is a strong probability—if not certainty—that the tumor is free, and that the complication of adhesions is not likely to be severe. When the tumor is fixed to the abdominal walls this mobility of the cyst is not present, and it will be well therefore for us, before we pass on, to consider how these adhesions are to be treated.

They may present themselves to the surgeon on the completion of the

abdominal incision in two forms. *Firstly*, as forming a complete and compact union between the peritoneal covering of the cyst and the abdominal peritoneum; and *secondly*, as loose and fibrous connective bands. These last are easily treated, and for the most part readily broken down, and when due to old tapping operations—a common condition—they may be destroyed by the careful introduction of the finger through the margin of the wound.

When a firm and compact union, however, exists between the cyst and the abdominal peritoneal membrane, the surgeon will have lost his guide as to the depth of his abdominal section, and he may experience some difficulty in deciding whether the abdominal cavity has been opened or not.

Under these circumstances he must be careful in his procedure, for he is not far from the possibility of perpetrating a fatal error,—the separation of the parietal peritoneum from its muscular connections. How is this error, therefore, to be avoided? By a simple process—by merely extending the abdominal incision upwards until the distinct line of separation between the cyst-wall and the abdominal peritoneal membrane is clearly seen. With this unerring guide before the eyes of the surgeon, the error to which I have alluded can be guarded against, and the next step of the operation safely proceeded with—the breaking down of the adhesions. As a rule, this may readily be done by the careful introduction of the finger between the cyst-walls and the peritoneum of the abdomen; some little force is here perfectly justifiable, for if the adhesions are confined to the abdominal parietes, and can be torn through, there is rarely much subsequent danger to be apprehended. Extreme care is, however, required at this stage of the operation. The surgeon should, by the introduction of his finger, make out the extent of the adhesions, and test their strength; if found to be numerous, and too firm for separation, the operation had better, at this stage, be abandoned, and the wound closed; or should many visceral adhesions of a firm character be present, it would be well to follow the same practice, for far greater danger lies with the latter than with those mentioned as attached to the abdominal parietes. It is difficult, if not impossible, to describe with anything like accuracy the extent or character of adhesions, such as would justify the surgeon in abandoning a case, and closing a wound after its commencement. The careful study of reported cases, and experience alone, will enable surgeons to decide with certainty upon these points. Still, as a broad rule, it may be asserted that parietal adhesions may be fearlessly treated when they can be divided, but those connecting the cyst with the viscera and the pelvis are always to be regarded with alarm; that the amount of force which may be regarded as permissible in the treatment of the former class of cases would be quite inexcusable when the viscera are concerned; and that moderate force should alone be employed, for all violence is to be condemned.

The fear of hemorrhage from the lacerated adhesions should always be before the surgeon, and the torn surface must always be carefully examined, with a view to its arrest.

Omental adhesions particularly should be examined with care, and torn through with caution, for they are very vascular and cannot be treated with too much consideration; as a rule, they should be divided and secured with a fine ligature of silk or carbolized catgut; their forcible separation is always bad. Firm band-like adhesions may be similarly treated. The ends of each ligature may be cut off and the knot left in. When, however, the incision has been made, and there is evidence that no adhesions exist between the cyst and the internal abdominal walls, it appears to be an unnecessary practice, for the operator to introduce his hand into the abdomi-

nal cavity with the view of learning whether they exist or not. Adhesions in front must necessarily be broken down, but I believe it to be the best practice to separate all others as they manifest their presence during the removal of the tumor, and by following this practice it will sometimes be quite unnecessary for the operator to introduce his hands into the abdominal cavity at all. Adhesions can frequently be broken down by the finger of the operator, introduced at the margin of the wound; and as the cyst empties, these adhesions are necessarily brought forward; when they do *not* exist the peritoneum escapes even the touch of the hands of the operator. In complicated and exceptional examples of this operation, it is clear that this practice cannot be followed, but in the more ordinary and simple cases it is most applicable. In many examples which have fallen into my hands, the value of this advice has been well proved, for in them the peritoneum was touched only by the knife and needle.

The Treatment of the Pedicle.—If there be one thing more than another in the practice of ovariectomy which presses for a solution, it is the treatment of the pedicle, for the practice of different surgeons on this point varies extremely, and the multiplicity of methods is most confusing. In France, Maisonneuve twists off the cyst by continued torsion, leaving the pedicle to fall back into the abdomen; whilst Nélaton prefers to fix the pedicle externally, and secure it by means of a common clamp. In Germany, Martin and Langenbeck cut through the peritoneal covering of the pedicle by a circular incision, cut off the tumor, tie each vessel separately, and fix the pedicle to the walls of the abdomen by means of a double ligature. Dr. C. Clay fastens the pedicle by a double ligature, cuts off the tumor, and, having allowed the pedicle to drop backwards into the pelvis, brings the ends of his ligatures out through the lower end of the incision. Dr. Tyler Smith fastens the pedicle in the same way as Dr. Clay, but differs from him in the important respect of dropping both pedicle and ligatures, which are cut off close, into the pelvis, and he then closes the wound. Dr. Keith and Mr. S. Wells prefer to fix the pedicle externally, by means of a clamp; and Mr. B. Brown and Skölberg to divide it by the actual cautery, and allow it to drop back into the pelvis. Atlee, of America, employs the *écraseur*. In my own practice I have adopted no one single method, having been influenced in my decision by the special peculiarities of each case.

If we refer to the results of the practice of different operators, who have been in the habit of adopting the various plans to which I have alluded, it will be seen that good success has attended each. Upon the whole, however, possibly the best results have attended the practice of fixing the peduncle externally.

The first object the surgeon has in view in the treatment of the pedicle is to prevent hemorrhage, and in the attainment of this end, to employ such means as are the least liable to excite, or be followed by, peritoneal inflammation. When experience has decided upon a plan which will with certainty secure these two objects, the one great problem which attends the practice of ovariectomy will have been solved, and the mortality of the operation will, doubtless, be much diminished. In the infancy of ovariectomy the early operators treated the pedicle upon the simplest principles; they secured it by one or two ligatures and brought the ends of the ligatures out of the wound; but subsequent experience has taught us that the fastening of the pedicle by one ligature is a dangerous practice, and cannot be adopted with safety. It does not attain even the first object the surgeon has in view, namely, the security from hemorrhage; and the mortality of the cases in which it has been employed has been very great. In the fol-

lowing figures of Dr. Tyler Smith this fact is shown conclusively, for out of 179 cases in which the pedicle was ligatured in two or more parts, 122 recovered, and 57 died, or 31.8 per cent. In 48 cases in which the pedicle was ligatured singly 22 recovered and 26 died, or 54 per cent.; the mortality of the cases in which the single ligature was employed compared with those in which the double ligature was used being as 54 per cent. to 31. The practice of fastening the pedicle by a double ligature, and of bringing the ends out of the wound, however, still exists, and in Dr. Clay's hands has proved successful.

The fear of exciting peritonitis by the presence of such a foreign body as a double ligature hanging from the wound, and the natural dread that surgeons entertained of evil consequences from the decomposition of the extremity of the ligatured pedicle within the pelvis, rendered the minds of surgeons dissatisfied with the practice just described, and, induced Mr. Duffin to urge the expediency of keeping the strangulated stump of the pedicle outside the wound; and Mr. Hutchinson perfected the practice by the introduction of the clamp. Up to a recent date this practice has been generally approved, and, as can be seen by the statistics of the different operators, it has hitherto borne good fruits; still, to the minds of reflective men, the practice was not so satisfactory as could be wished; the good which was evidently acquired by the maintenance of the secured pedicle external to the wound was neutralized in certain cases by an undoubted evil. When the pedicle was long and narrow, the method appeared to be good and successful; but when the pedicle was short or broad, many bad effects became perceptible—evils which could only be attributed to the traction upon the uterus and its appendages from their pelvic position. It was thus, therefore, that other plans of treatment were looked for, by which this traction on the pedicle could be obviated, and yet security from hemorrhage be guaranteed.

The plan of treatment which naturally suggested itself was the dropping in of the pedicle with the divided ligature, and this was first done in 1829 by David Rodgers, of New York, who, in removing an ovarian tumor, applied a ligature to the pedicle, cut short both extremities of the ligatures, returned the pedicle into the abdomen, and closed the external wound. His patient made a good recovery.

This plan of treatment, however, did not meet with general approval; it was too bold, and was inconsistent with all past experience and professional prejudices; it fell to the ground; it was however at intervals repeated by other surgeons with tolerable success, and has now gained a strong hold on the professional mind, and bids fair to become a more general practice. I may here mention that Sir B. Brodie had some confidence in this practice, for in 1843, when discussing the case upon which Mr. Aston Key had operated at Guy's Hospital without success, he expressed his belief that the right treatment of the pedicle was to drop it in and close the wound, and that if success was to be secured, it was by such means. I make this statement on the authority of Dr. Oldham, who heard the remark.

In a fatal case recorded by Dr. Peaslee in the "American Journal of Medical Science," July, 1865, in which this practice was adopted and death followed the operation on the seventeenth day, the extremity of the pedicle was found to be atrophied, but not sloughing, and the ligature was covered with an exudation of lymph, which had already become somewhat organized. In a case which occurred in my own practice, in which the pedicle was secured with a carbolized cat-gut ligature, which was cut short and dropped in, when the patient died, a year subsequently, from some other cause than the disease, no traces of the ligature were visible, not even an

adhesion, the fimbriated end of the divided pedicle being free. In our profession, however, a theory, when once established, rapidly develops, and a practice which is based on a received principle soon improves. The professional mind having realized the fact that the pedicle of an ovarian tumor might be with safety strangled by a ligature, dropped into the abdomen, and the wound closed, and having been taught by the results of experience that the strangled extremity of the pedicle did neither decompose nor set up any peritoneal mischief, looked out for some other plan of treatment, by which the presence of the foreign body—the ligature—might be done away with. As a result, the division of the pedicle by the actual cautery has been introduced; the treatment by the *écraseur* does not meet with support. The use of the cautery is a bold practice, and has the advantage of past experience in its favor, for from the earliest times the hot iron has been a favorite means of arresting hemorrhage, even from large vessels. In the veterinary art it is also still constantly employed. Mr. Brown, to whom the credit of its application is unquestionably due, tells us that his experience of this form of practice is very good, and that of Skölberg, of Stockholm, is certainly startling. But hemorrhage at times follows the practice and renders it uncertain. I have lost one patient from this cause.

Upon the whole, the evidence seems to show that the practice is a good one in certain cases—that in short, fleshy, and broad pedicles, the cautery is efficient, but that in the long and thin pedicles it is not required, other treatment being more applicable. More facts are, however, required, before the cautery can be generally received into practice, and by means of the cautery, aided by the crushing of the pedicle's extremity, safety may be found, even in extreme cases.

What, then, it may be asked, is the right treatment of the pedicle of an ovarian tumor? Is it always to be secured by one method?—and if not, under what circumstances is the plan to vary?

The object the surgeon has in view is to control and prevent hemorrhage in a way that is the least likely to excite any undue peritoneal inflammation; the less there is left of a foreign body within the abdomen, the better must be the practice. Going back to past experience, we have learnt that if the pedicle is to be tied, it must be tied in at least two places; and that all traction upon the pedicle, and, as a consequence, upon the uterus, is to be regarded with apprehension, and should, therefore, be avoided. We have learnt that the pedicle may be ligatured in two or more parts, dropped back into the pelvis, and that the ends of the ligatures may be left hanging from the wound with a good result; and that the pedicle may also be fastened externally by means of a clamp with equal success. But we have also learnt that good success is gained by dropping the pedicle into the abdomen, after its division by the crushing clamp and cautery, or after it has been ligatured in two or more portions, and the ends of the ligature have been cut off.

It would appear, as far as present experience has gone, that in long pedicles the best practice is to fix them externally by means of a clamp; in short and broad pedicles, in which the vessels are usually small, the cautery may be employed, or the pedicle ligatured in two or more parts with carbolized catgut, the ends of the ligatures cut off and dropped in, and the wound afterwards closed.

Should subsequent experience prove that the cautery is to be relied on, whether aided or not by other means, we shall doubtless have discovered a plan of treatment which bids fair to do more for ovariectomy than any other improvement of modern times. Hitherto it has been in the treatment of short and broad pedicles—the class of cases for which the actual cautery is

now proposed—that ovariologists have experienced so much difficulty; but at present the practice can hardly be said to have yet arrived at any state of certainty.

In the treatment of adhesions our practice is to be governed by like principles. When they are slight, they may be broken down; when strong, they may be divided or ligatured, or perhaps destroyed by the cautery. When large vessels exist they must be tied until the crushing and cauterizing plan of treatment has been perfected. But at present let no risk be run, let the ligatures be applied, and their ends cut off, rather than incur any chance of bleeding.

On Sponging out the Pelvis.—The tumor having been removed, and the pedicle secured, it will be well for the surgeon to examine the opposite ovary, to be sure of its healthiness, and then to turn his attention to the presence of the fluid or blood that may have escaped into the pelvis during the operation. Should the fluid of the ovarian cyst have been of the serous kind, and the evidence of the extravasation of blood into the abdomen be purely negative, there will be little or no need of running the risk of irritating the peritoneum or pelvic organs by the application of a sponge; for the thin serous fluid of ovarian cysts is readily absorbed, and the presence of a little blood is of small consequence, for we know from experience that blood may be extensively effused into a joint, and no evil follow, as it may into the cellular tissue of a part, and yet be absorbed. Obstetricians will also readily recall cases in which blood has been effused into the peritoneal cavity without, of necessity, any serious result. A sponge should not, therefore, be applied to the delicate surface of the peritoneum without good reason, and where the fluid of the ovarian cyst has been simply serous, and there is no evidence of the effusion of blood in any quantity, there is no need of its use. When required, it should be a new one, of the softest kind, and well warmed, two or more dips into the pelvis being carefully made, to free the cavity from all foreign matter. The sponge appears to me to be far preferable to any flannel, for, when properly cleansed and soft, it is most unirritating, and not so likely as flannel to leave behind it any foreign matter. The sponge should always be carefully employed when there has been any escape of mucus or other thick ovarian fluid, and when much blood has been effused; indeed, in some cases much care is required to cleanse the pelvis from all such irritating materials.

Treatment of the Wound.—The operation completed, the pelvis cleansed, the opposite ovary examined, and all signs of hemorrhage absent, the surgeon may then proceed to the closure of the wound. He should do this by means of deep and superficial sutures. He may use silk or silver sutures, according to fancy. In my early operations I chose the silver ones, but I have now discarded them, as I do not find them less irritating than silk, and in their removal they are more prone to scratch and tear the tissues through which they are drawn than the fine silk plait I am now in the habit of employing. The fine white plait, sold by fishing-tackle makers, is by far the best.

It is not yet decided whether the peritoneum should be included in the sutures or not. The fact that different operators adopt different plans with equal success tends to prove that the point is not of much importance. In my earlier operations I, as a rule, included the peritoneum; in more recent cases I have omitted to do so, and, upon the whole, I do not think the matter is of much consequence. The sutures should, without doubt, include the muscles. They should be inserted at intervals of one inch, and be well secured; other intermediate superficial sutures should be inserted through the skin. When union has taken place, the sutures should be re-

moved; any time between three and six days will, as a rule, be suitable; but when repair has taken place, there is no object to be gained by leaving them *in situ*. They are then foreign bodies, and should be removed.

The After-treatment.—Whenever a patient has taken chloroform or any anæsthetic mixture, it is always a good practice to keep the stomach as quiet as possible, and as the benefit of an opiate after the operation is always great, it is the best plan to administer one by the rectum. In abdominal operations this practice is one of great value, and for some years I have been accustomed to give a half-grain morphia suppository after every ovarian operation, as well as after others of hernia, ruptured perinæum, &c. The suppository should be administered before the patient has recovered from the effects of the anæsthetic, and care should be taken that it be passed well up the rectum. Should pain appear, the suppository may be repeated, but it is rarely necessary to administer it more than once a day—at bedtime. The patient's room should be kept cool and airy, as in other cases of operation. For the first two days, milk and arrowroot are generally the chief diet; but should sickness be present as a result of chloroform, ice and milk, or ice and soda water should be administered; everything should, at any rate, be cold. Should sickness still continue, food should be given two or three times a day, by the rectum. As soon as the stomach will admit, fresh meat, brandy, and wine should be carefully given, the object being in these cases, as in all others of general surgery, after the first three days, to keep up the powers of the patient, and so enable nature to complete the cure. One thing, however, is of essential importance in these cases, and that is to prevent the patient straining her abdominal muscles in the slightest degree. The urine should, therefore, be drawn off periodically by the catheter, and when the bowels require relief, their action should be rendered easy by the use of enemata. The bladder should never be allowed to become distended, nor should the bowels be left loaded too long.

On the use of opium a few remarks remain to be made, for upon this point the practice of surgeons appears to be undergoing a change. In the early operations of ovariectomy it was extensively employed, and at the present time some surgeons are still free with its use, but there is good reason to believe that in this operation, as in others, a too free administration of this drug in every case, is not attended by such good results as could be wished; and that, in a patient under its full influence, a wound does not repair so rapidly and favorably as another in whom natural processes are allowed to progress without interference. Opium, carefully given to allay pain and cause sleep, is a drug upon the value of which there is no room for doubt. But opium administered with sufficient freedom to bring, and repeated often enough to maintain, a patient under its influence, is a drug in the use of which a surgeon should be on his guard.

In ovarian cases it should not be given in larger quantities than are found sufficient to allay pain and secure sleep. A patient should not be kept under its full influence, save under exceptional conditions, for wounds do not unite so well with a patient fully under the effects of this drug as under other circumstances. It is best administered, also by the bowel. It is less liable to cause its injurious effects, and is more liable to produce its good ones. It is absorbed, at least, as rapidly by the rectum as by the stomach, and, in abdominal operations, it tends much to maintain that requisite quiescence of intestinal action, which in all such cases is so desirable. In my own practice I have been accustomed for some years to administer opium by the bowel in preference to the stomach in all cases of abdominal surgery.

On the Treatment of Suppurating Ovarian Cysts.—When an ovarian tumor is breaking down and undergoing disorganizing or suppurative changes, whether spontaneously or after tapping, it has been already stated that it is the surgeon's duty to interfere and to remove what is a serious source of constitutional irritation, and what, if left to itself, will to an almost dead certainty destroy life. This should be done by means of an exploratory operation. When the tumor can be removed as a whole, so much the better; but when it has contracted such adhesions with the parts around as to be practically immovable, as much of the tumor should be turned out of the parent cyst as possible, and the cyst itself stitched to the margins of the wound, the suppurating cavity being well washed out once or twice daily, and a drainage-tube left in. I have recorded a good example of this practice in the "Guy's Hosp. Rep." for 1868, in which a woman, æt. 34, was successfully treated by these means.

Extirpation of the Uterus.—This operation—extirpation for fibro-cystic disease and for fibrous tumors filling the abdominal cavity—is one that will probably become more frequent as time progresses; but under any circumstances the operation ought only to be undertaken when the tumor has acquired such dimensions as to threaten life, or render what remains miserable. These tumors have often been mistaken for ovarian, and operated upon as such, the mistake in diagnosis having been discovered only during the operation. They are usually slow in their growth, very solid in their nature, and low down in their pelvic position; they usually also attack women at a later period of life than ovarian tumors.

The fibro-cystic uterine tumors, however, often present all the external features of the more solid ovarian, and cannot be diagnosed, more particularly, when a pelvic examination reveals but little. When the uterus can be made out to form part of the tumor, and to move with it; when the uterine sound can be passed freely into the cavity of the uterus, and to extend far beyond its normal distance; when at each monthly period the flow is profuse; when the tumor is fixed well in the pelvis, and the abdominal veins, &c., are turgid from its mechanical pelvic pressure, something more than a suspicion of its fibro-cystic nature may be formed; but when none of these symptoms are present the diagnosis cannot be made with certainty.

The operation of extirpation of the uterus has been performed with success by Clay of Manchester, Storer of Boston, Koeberle of Strasburg, Wells and myself. My own case was in the person of Miss M—, æt. 26. The tumor had been growing for three years, and for this she had been under the care of Dr. Oldham, who believed the case to be one of ovarian disease. He sent her to me for operation. On May 19th, 1871, I operated, and, finding the uterus and both ovaries diseased, I removed the whole, fixing its base with a large clamp; an uninterrupted recovery took place. Full particulars will be found in the "Trans. of Obstet. Soc.," 1872.

I have operated on three other cases, but not successfully, one patient dying from hemorrhage, caused by the rupture of a pelvic vein, and the others from the shock of peritonitis. In two I removed the uterus and its tumors by means of the chain écraseur, made by Meyer, of Great Portland Street, and believe this to be the best instrument for the purpose; the chain is passed well round the peduncle of the growth, and screwed up slowly.

This operation is the gravest that the surgeon can undertake, the shock to the system being far greater than in ovariectomy. A good account of the cases done, up to 1866, will be found in the "American Journ. of Med. Science" for January, 1866.

CHAPTER LXII.

ON LOCAL VENEREAL DISEASE.

Urethritis, gonorrhœa, or clap, are terms applied to cases of inflammation of the urethra of every degree of intensity, and the product of a great variety of causes. In some the affection is the consequence of the direct irritation of an instrument passed or left in the urethra, in some it follows excessive sexual intercourse, or ordinary sexual intercourse with chaste or unchaste women who are out of health and are suffering from acridity of the vaginal secretion. But most commonly it is the direct product of contagion from the pus of an inflamed mucous membrane, specific or otherwise. Simon ("Holmes's System," vol. i) has shown that "there is ample room to question the popular impression that only specific inflammations are communicable; much reason for suspecting it, on the contrary, to be a generic and essential property of inflammation, that its actions are always in their kind, to some extent, contagious," pus from an acute inflammation producing its kind on inoculation.

Lee states ("Holmes's System," vol. v, ed. 2) the causes of urethritis to be the application of a gonorrhœal discharge to the sexual organs. Certain irritating substances applied to the mucous membranes, *e. g.*, menstrual fluid, leucorrhœal discharges, &c., and other irritants, such as the injection of a solution of ammonia, and some constitutional cause, such as gout or rheumatism.

Complaints closely resembling gonorrhœa sometimes appear in persons the subjects of stricture, after sexual intercourse, a debauch, or other excitement. It is well to bear in mind Ricord's observation that gonorrhœa often arises from intercourse with women who themselves have not the disease; and Diday's, "that from the very fact of a woman having a discharge, no matter what its origin, she is liable to give a discharge to a man."

The disease may be *acute* and come on within a few hours of connection, or it may fail to show itself for five or ten days, and in a general way the sooner the symptoms appear after the contagion, the acuter the disease. It may be *subacute* or *chronic*.

It generally commences by an itching, about the orifice of the urethra and the sensation of heat on micturition, the mucous membrane of the urethra probably appearing swollen and injected, and, after the lapse of a few hours, some muco-purulent fluid will be squeezed out of the urethra. In acute disease the urethral discharge will soon become abundant, and pus, yellow, green, or blood-stained, will flow from a highly injected and swollen urethra; the whole glans and penis will be red, swollen, and painful; micturition will be probably difficult, painful, and scalding, the passage being obstructed by the swelling of the mucous membrane.

Chordee, or painful erections, will soon appear, this symptom being due to the stretching of inflamed and infiltrated tissues, and as the disease advances, perineal pain, if not suppuration, may appear. The groins, testicles, and perinæum will more or less be the seat of tenderness; and constitutional symptoms exist, varying with the degree of the inflammatory action, in some subjects the febrile condition being well marked, but in most it is absent. After the lapse of ten or fourteen days these acute symptoms may partially subside, the discharge will become thinner and more muco-purulent, the external signs of inflammation will be less marked, the pain on

micturition less severe, the perineal, inguinal, or scrotal pain will probably have disappeared, a thin muco-purulent urethral discharge with a slight sensation of heat on micturition alone remaining.

When these symptoms are allowed to run their course unchecked they will gradually pass into the condition known as that of *gleet*, in which a thin muco-purulent urethral discharge exists, unattended by any local or general source of pain. *Gleet* may, however, be the result of some stricture, or some local urethral disease, such as an ulcer.

The ordinary seat of the affection is in the mucous membrane of the urethra, the orifices of the lacunæ being chiefly involved. The fossa navicularis and parts around are the most common seats, and the mucous membrane of the bulb; the dissections of Sir A. Cooper, Ricord, Thompson, and others, have proved this. At times, however, gonorrhœal inflammation may, as Wallace pointed out ("On Venereal Disease"), involve at the same time the whole of the urethra, the bladder, the testicles, the glans, and the prepuce, in the male; and in the female, the nymphæ, clitoris, vagina, &c., the disease, as it creeps along to the posterior part of the urinary passage, decreasing in intensity in the anterior. In severe cases, the inflammation may extend to the submucous tissue, inducing thickening and even suppuration.

Urethritis, the result of some mechanical irritation of the urethra, is rarely acute, and it, as a rule, subsides as soon as the cause has been removed.

Urethritis, the consequence of some gonorrhœal contagion, is almost always acute, and having once been started is not readily arrested.

Gleet, whether the consequence of an acute or subacute inflammation, when of some standing, is almost always due to some urethral contraction or stricture.

In the female, gonorrhœa is to be recognized as a yellow purulent vaginal discharge. The less purulent it is, and the more the discharge is made up of mucus and epithelium scales, the greater is the probability of the disease being due to vaginal irritation other than gonorrhœal, that is, to leucorrhœa; and when the vaginal discharge is made up of masses of glutinous, semitransparent, albuminoid material, like the white of egg, the more certain is it that the discharge is uterine, from the glands of the neck of the uterus, or uterine gonorrhœa.

It must be remembered, however, that in both sexes, as long as any purulent or semipurulent fluid is poured out by the mucous membrane of the genital passage—even the slightest gleet—a violent urethritis may be given to another subject by contagion, and there is good reason to believe that sexual excitement is an important element in aiding the propagation of contagion.

TREATMENT.—Gonorrhœa or urethritis is a local disease, and may be treated locally with success. When the result of local irritation from the passage of an instrument, no treatment is called for, the discharge ceasing naturally as soon as its cause has been removed, but when from gonorrhœal contagion a like success is not met with.

In a very acute clap, when the urethra and penis are swollen from vascular turgescence, free purgation with salines is certainly the best practice, and at times, in plethoric patients, the addition of some antimony in quarter-grain doses to excite nausea is most valuable.

In less severe cases copaiba may be given in doses of twenty drops or half a drachm three times a day with advantage, but this drug is not to be continued for more than three days. If it is to do good it will show its influence in that time, and a longer continuance of the drug is useless

and deleterious. The yellow oil of sandal-wood may also be employed in the same dose, and under like circumstances; at times it acts most beneficially, even when the copaiba has failed, but it is in no way certain in its action.

Astringent injections are always of value when they can be used frequently and efficiently. Strong injections are to be condemned; they may cure the disease suddenly, but more commonly they fail to do so, and set up bladder and other mischief, adding, indeed, to the irritation.

The best injection in all stages of the disease is tannin, in the proportion of three to six grains to the ounce, and next to this is alum or the chloride of zinc, in the proportion of two or three grains to the ounce. To be of use they should be used from four to six times in the twenty-four hours. An ordinary glass syringe will answer every purpose if the glans penis be well held, but any of the special syringes will do very well. During this treatment the use of alkalies, such as the citrate or tartrate of potash, in twenty-grain doses, or ten grains of the bicarbonate may be given, good food being allowed, but little stimulant.

In the chronic stage I have found great use from the introduction into the urethra of a large catheter covered with the glycerin of tannic acid, and at times the Suppositorium Acidi Tannici, rolled into sticks and passed into the urethra, acts most beneficially.

The best way to give copaiba is as a bolus, mixed with calcined magnesia and wrapped in wafer paper, or as a mixture with gum and peppermint water. The capsules are uncertain in their action. Copaiba is well known to produce in some patients a severe rose urticarious eruption. Cubebs are less to be relied on than copaiba.

In using injections the object is to make an impression upon the mucous membrane by their astringent effects, and to keep it up. Weak astringents frequently employed are far more valuable than strong ones at longer intervals. When so used they are as useful in gonorrhœal inflammations of the urethra as in that of the eye. When a man can devote himself to the cure of his clap, and throw into his urethra a weak astringent every hour, he will often check it within two or three days, in the same way as a gonorrhœal inflammation of the eye may be controlled under similar treatment. The nitrate of silver injection is an uncertain and, at times, a dangerous remedy, adding often to the disease instead of diminishing it. In all cases of long-continued clap or gleet in the male, the presence of a stricture should be suspected. It may often be made out by the passage of the *bougie à boule*, when an ordinary catheter fails to detect it. The gleet is only to be satisfactorily treated by the cure of the stricture, that is, its full dilatation.

Tonics, particularly iron, are valuable adjuncts to the treatment.

All sexual excitement or connection are to be forbidden for some time after the apparent cure of a clap, for any attempt is likely to be followed by a relapse. Drinking and smoking to excess are injurious.

In women a clap is readily cured by the frequent use of astringent injections of tannin, alum, or zinc, ℥ss. to a pint; the passage into the upper part of the vagina of the tannic acid suppository is, however, an excellent treatment.

In the use of both these means the patient should lie down with her hips raised, and the astringent should be allowed to remain in the passage. To inject it sitting or standing is a useless, although too common, practice.

Complications.—Inflammation of the *epididymis* is the most common complication, the disease, doubtless, spreading in a direct way from the urethra, through the vas deferens and cord to the epididymis. In some

cases it stops at the cord; in others, it goes on to affect the testicle itself. It is often associated with hydrocele, and it is from this fact that some surgeons have been led to believe that inflammation of the testicle itself is a common consequence of a clap.

The treatment of this affection has been considered in chapter lviii.

Inflammation of the *ovary* in the female is said to occur, and even *pelvic peritonitis*.

Abscesses in the cellular tissue external to the urethra, penile or perineal, are often met with in acute gonorrhœa. They should be opened early.

Chordee is a common consequence, and a very painful one; full doses of opium (gr. j), or ten grains of henbane, and a like dose of camphor, are reliable remedies. Ricord uses a suppository of ten grains camphor and one grain of the extract of opium; and I have sometimes thought the morphia suppository the most useful; belladonna smeared over the urethra at times gives relief.

Retention of urine may likewise occur from the mechanical closure of the urethra through its swelling, from spasm of the urethra, or from both causes. The warm bath and opium are the best remedies for the complication, a catheter being passed only when an absolute necessity exists.

Inflammation of the prostate is likewise a complication, as also is *inflammation of the bladder*. (Vide chapters xlvii and xlviii.)

Inflammation of the inguinal glands, or sympathetic bubo, is often present, the glands occupying the upper part of the groin being usually involved, but those below Poupart's ligament are not seldom affected. In neglected cases these glands may, indeed, suppurate. Fomentations and tonics are the treatment called for. The absorbents of the penis are at times inflamed and suppurate.

When the external parts of the penis are involved in the inflammation—that is, the glans penis and prepuce—*balanitis* is said to be present. When the prepuce becomes œdematous and is long, *phimosis* takes place; when narrow and retracted behind the glands so as to be irreducible, *paraphimosis*.

This balanitis is to be treated locally by astringents, such as the acetate of lead lotion, or that of the nitrate of silver, v–vj grs. to the ounce, painted on the inflamed part, the phimosis and paraphimosis being treated on general principles.

As a consequence of *balanitis*, *warts* are very common; they may cover the mucous membrane of the glans and prepuce, or invade the urethra itself; they may grow to a great size, putting on much the appearance of a cancerous penis. I have seen them perforate the prepuce of a penis when phimosis was present.

They can only be treated by removal; when extensive, their excision is the best plan—the operation being performed with the patient anæsthetized—the nitrate of silver or perchloride of iron being freely applied to the base of the warty growths, or the galvanic cautery. In less severe cases the warts will often wither if kept dry with the oxide of zinc, or the fresh powder of savin.

All warts are not, however, gonorrhœal; they may arise without any such cause even in clean subjects. They are, nevertheless, contagious. In women they are often found up the vagina, but more frequently at its orifice.

Gonorrhœal rheumatism, so called, is an undoubted complication of the disease, explain it how we will. At the end of an attack of clap patients are, without doubt, often attacked with severe pain and tenderness of one or more joints, attended with effusion and constitutional disturbance. It

may occur with every fresh attack of clap, and I have recorded a case in my book on the joints in which it recurred sixteen times, after sixteen different attacks of gonorrhœa. Some authors look upon this affection as a species of pyæmia, due to the absorption of some morbid matter from the inflamed urethra, but evidence is still wanting to prove the truth of the theory. It rarely appears during the acute stage of the affection, mostly in the chronic, but no arrest of the discharge can be associated with its appearance. The knees and ankles are the joints mostly involved, but those of the upper extremities are so at times. The fair-haired and what are called strumous subjects are said to be the more prone to the disease. I cannot say I have observed this.

At times the rheumatic pains are more confined to the tendons and muscles; the heels and soles of the feet are frequent seats. The late Dr. Babington used to say that this form was found only in those who had taken copaiba.

TREATMENT.—In the acute stage fomentations locally, with or without poppy-head decoction, or the extract of opium, and the internal use of Dover's powder, with alkalies, are the best means to adopt; in the more chronic stage the iodide of potassium and opium appear to have some influence over the disease. It is, however, at all times obstinate.

Herpes Preputialis.—This is a simple affection, which may be mistaken for chancre; it is known by the appearance of a crop of vesicles around the corona of the glans, or upon the external or internal surface of the prepuce. It is generally attended by much local irritation and local evidence of inflammation, the vesicles when they burst often discharging freely. The affection runs its course in a few days, when the parts heal; a zinc lotion of three or four grains to the ounce expedites recovery, or a solution of nitrate of silver, gr. v to the ounce.

The number of vesicles and their grouping is generally sufficient to enable the surgeon to diagnose this affection from a venereal disease.

On Chancre.—A chancre may be defined to be a sore, the result of venereal contact; in a general way it is found upon the penis of the male and genitals of the female, but it may be seen upon other parts of the body, such as the pubes, thighs, lips, tongue, nipples, fingers, &c., &c.; in fact, wherever the secretion from a sore may be applied to another surface.

In by far the larger number of cases this disease is a local one; it begins and ends as a local affection; in the smaller number it is a local inoculation of a constitutional disease, and is followed by syphilis. The sore is not syphilis although it is the direct means of communicating syphilis, no more than the inoculation of small-pox is small-pox, although the inoculation may be the means of giving small-pox.

So long as the disease is a local one it is comparatively unimportant, however troublesome it may be in healing, and however extensive. But whenever it is the local inoculation of a constitutional affection such as syphilis, it is of grave importance, however apparently trivial may be the local sore.

The question becomes, therefore, a vital one to make out from the local appearances and conditions of the sore whether it is likely to prove a local disease only, or to be followed by constitutional symptoms, and to a certain extent this diagnosis may be made; that is, a surgeon may from the external appearance of a chancre go so far as to say that in all probability this one will not be followed by syphilis, and that one will; but he can do no more; to dogmatize upon the point, and to speak with certainty, is beyond his power.

The chancre which will not in all probability be followed by syphilis is

the *soft suppurating sore*. The chancre that will in all probability be followed by syphilis is the *hard non-suppurating sore*.

John Hunter thus described the indurated chancre: "The sore is somewhat of a circular form, excavated, without granulations, with matter adhering to the surface, and with a thickened edge and base. The hardness and thickening are very circumscribed, not diffusing themselves gradually and imperceptibly into the surrounding parts, but terminating abruptly." In this description we read the type of the hard infecting chancre—the chancre of the inoculation of syphilis wherever found. Hunter adds, however, that "a chancre has commonly a thickened base; and, although the common inflammation spreads much further, yet the specific inflammation is confined to this base." An infecting chancre may, however, appear only as a crack, excoriation, or indurated tubercle, without abrasion.

This form of chancre is commonly associated with some induration, not suppuration, of the first row of the inguinal glands, the *multiple indolent bubo*. Its secretion consists of epithelial debris, of globules of lymph more or less perfectly formed, or disintegrating, and of serum, *not pus*, and not auto-inoculable.

The *soft suppurating chancre* is often multiple, has an excavated surface with neatly shaped and cut edges, as if the wound had been punched out. It has an irregular and worm-eaten surface, secreting abundance of pus. It is prone to spread rapidly and to become phagedænic. It has usually a soft base, but if otherwise it will have what Ricord has described as a phlegmonous hardness, and not a defined one, as in the syphilitic chancre. It is commonly associated with a suppurating bubo, and always secretes pus, that "has the property of always reproducing its specific action when applied to another part of the same body, or when inoculated upon another person." (H. Lee.)

The experiments of Fournier, Rollet, and Lee's observations lead the latter surgeon to "conclude that if a venereal sore yields a secretion capable of being inoculated so as to produce the specific pustule, the evidence, so far as it goes, is in favor of its being a local disease, and not requiring constitutional treatment. If, on the contrary, a disease which we believe to be primary syphilis yields a secretion which is not auto-inoculable, then the evidence is against the local character of the affection, and indicates a constitutional mode of treatment."

In this we read the type of the simple local venereal sore.

The secretion from a simple suppurating, non-infecting chancre, writes Lee, to the eye and microscope presents all the characters of ordinary pus. If in any doubtful case some of the secretion be mixed with dilute acetic acid, the distinctive characters of pus nuclei will be seen. "The secretion from an *infecting chancre*, when the disease is not accompanied with irritation from any accidental cause, is not pus, it consists of epithelial debris, of globules of lymph more or less perfectly formed, or of these same products undergoing disintegration, and of serum more or less turbid. In debilitated and unhealthy subjects," adds Lee, "infecting sores will suppurate as any non-specific lesion would do, and in such cases it is sometimes very difficult to distinguish the secretion produced by the local disease from that which depends upon constitutional peculiarity."

Unfortunately, however, in a clinical point of view, this great distinction between the two forms of chancre is not always to be made out; and consequently an intermediate class of cases has to be recognized, approaching in its clinical features more the soft sore which is capable of giving syphilis.

There are, therefore, three forms of syphilitic sore, which the Committee on Syphilis has thus well described:

One characterized by induration throughout its entire course ;

One soft in its early stage, and becoming subsequently indurated ; and one soft throughout the whole course, but which, unlike the simple local sore, is followed by constitutional disease.

Hard sores do not of necessity give rise to syphilis, whilst soft sores may. And it is an undoubted fact that the question of induration or non-induration is greatly determined by the position of the sore. Chancres upon the female genitals, simple or syphilitic, and chancres upon the glans penis, are rarely hard.

The point, therefore, resolves itself into this—that the indurated chancre, with a fair amount of probability, although not certainty, may be the precursor of syphilis, and not prove only a local disease. The soft or non-indurated sore may, in exceptional cases, prove to be due to a syphilitic inoculation, and be followed by the constitutional affection, although in the majority of cases it is a purely local disease.

A crop of soft sores fringing the prepuce, or surrounding the corona, is in all probability a simple and non-syphilitic disease.

A spreading chancre, with a suppurating bubo, is, probably, a local affection.

A small single chancre, indurated from the beginning, is the most suspicious of syphilis, although even in this there is no certainty of its being so. In fact, it is not possible to speak with any certainty as to a chancre being syphilitic or otherwise. Syphilis is a constitutional disease, and is to be recognized only by its symptoms, not by the point of its inoculation.

With respect to the *period of incubation* of a chancre, simple or syphilitic, no definite time can be given ; it varies from a few hours to a week ; but the multiple suppurating simple chancres, as a rule, appear more rapidly after infection than any other. The syphilitic chancre often does not appear for at least a week after infection. Dr. Bumstead, of New York, says “that an interval of at least ten days will be found to have existed between infection and the appearance of the sore.” (Edition of “Cullerier’s Atlas of Venereal Disease,” 1868.)

A chancre, like any ordinary sore, may present different appearances at different times. At its origin it may be vesicular, papular, or pustular, or an excoriation, passing through the *ulcerating*, *granulating*, and *cicatrizing* stages. In some cases the ulcerating stage will be a long one, and the sore extensive ; in another it will be so brief as hardly to be recognized.

The action of the sore varies also with the condition of the patient, the condition of the part upon which it is placed, and probably the nature or stage of the infecting sore from which the disease has been communicated.

A chancre, like an ordinary sore, may become irritable, inflamed, or phagedænic, when there is much local action and little constitutional power, when drink, irregular living, and debauchery have so enervated the nervous system as to render the patient unable to withstand the effects of any local irritation, simple or syphilitic.

These various actions may also attack the chancre at any period of its progress. When a chancre becomes a sloughing or phagedænic one from the very first, and the chancre was an inoculation of syphilitic matter, there is every reason to believe that the sloughing process has a beneficial tendency, for the very intensity of the local effects of the poison may be the means of preventing its absorption, and thus the advent of syphilis.

When the sloughing action appears during the ulcerating or later period of the chancre’s progress, it will have no such beneficial influence ; for when syphilis is inoculated through a chancre, it is during its vesicular, papular, or pustular stages, prior to its ulcerative one, and no action of the sore that

appears after this period can have any influence in checking the diffusion of the poison. "If the inflammation spreads fast," writes Hunter, "it shows a constitution more than naturally disposed to inflammation; if the pain is great, it shows a great disposition to irritation; it also sometimes happens that they very early begin to form sloughs. When this is the case, they have a strong tendency to mortification." "These three conditions of a sore," adds Aston Key, commenting upon the above, "distinct in their cause and in their operation from the syphilitic action, are adverted to as pointing out the distinction that is to be drawn between the irritable, inflamed, and the sloughing chancre, and afford a guide for the pathological surgeon as safe and intelligible as the more elaborate descriptions of modern writers." ("Guy's Hosp. Rep.," 1840.)

Treatment of Chancre.—The uncertainty that most surgeons entertain as to the nature of any chancre, and the knowledge that any sore upon the penis, from a simple excoriation to an indurated chancre, may prove to be the inoculation of syphilis, renders it a desirable and expedient practice to destroy all such at the very earliest period of their development; and when this is effectually done before the ulcerative stage has set in, that is, during the vesicular, papular, or pustular, there is good reason to believe that syphilis is often prevented.

When the sore exists as an ulcer, this abortive practice is useless; in the majority of cases it makes a small sore a large one; it retards recovery, and in no way prevents syphilitic symptoms appearing where the chancre had had a syphilitic origin. But taking all chancres together, not one out of four has a syphilitic origin.

For the destruction of a chancre on its first appearance, nitrate of silver, nitric acid, potassa fusa, or chloride of zinc may be employed, the base of the sore being well destroyed.

When this is not done, the chancre should be treated on ordinary principles; when inflamed, lead lotion may be applied, with or without opium; when sloughing, opium internally, with tonics, is indicated; when indolent, nitric acid lotion or black wash are the best stimulants; to ordinary sores water-dressing should be used.

A chancre, as a chancre, beyond its primary destruction for motives of expediency, or for reasons of weight to destroy a supposed syphilitic inoculation, requires no special treatment. To apply black wash to all sores on the penis—a far too common practice—is not needed; and to cauterize all chancres no matter what the stage of their existence whenever they come under notice is equally unnecessary. When the powers of the patient are feeble, tonics are called for, and any special conditions are to be treated as common sense indicates.

Medicines useful for syphilis are only to be given when evidence of syphilis exists beyond that afforded by the local inoculation. To treat all chancres in the same way, as if due to syphilis, is uncalled for and unscientific; by doing so many patients are sacrificed to a theory greatly to their detriment.

Complications of Chancre.—**Phimosis** is one of the most common; it is found in at least a fourth of all forms of chancre and at all stages of their progress; with the sloughing sore it is probably the most frequent. In the fringing preputial chancres it is a common complication. It is an accidental accompaniment, and is due to the inflammatory infiltration of the prepuce. When not severe it is not a condition of much importance, if local cleanliness be attended to; as the chancres heal, the inflammatory oedema will subside and the parts assume their natural condition.

When, however, *oedema is present*, and from beneath the prepuce a blood-

stained discharge escapes, mixed with the débris of broken-up tissues, and the surgeon is thus in doubt as to the nature of the chancre, its position, and character; when, indeed, any evidence exists that the parts beneath are undergoing a destructive process which demands some direct local treatment for which exposure is needed, the prepuce must be slit up, the surgeon taking care to do so effectually; for by a want of due attention to this point the glans penis may be destroyed or the prepuce perforated. When the sore has been exposed it is to be treated on ordinary principles. When a simple purulent discharge comes from the orifice of the prepuce the constant use of water and simple lead or other injection will probably suffice. Phimosi without inflammatory œdema rarely calls for treatment.

Phagedæna.—Venereal sores may slough, as may others, the suppurating chancre being more prone to take on this action than the non-suppurating and indurated. When a sore is sloughing from the first, it probably ceases to be an infecting one, and even if syphilitic in its origin probably loses its syphilitic nature, the sore becoming a simple one when the sloughing action has ceased. This action is at times so intense that the penis rapidly swells after infection, inflames, and becomes gangrenous, the whole organ sloughing off; at other times the action will be more partial.

In exceptional instances the mortification will be of the dry kind. In the Peninsular War, when the British troops were in Portugal, this sloughing of the penis from inflammation was so severe that Inspector Fergusson ("Med.-Chir. Trans.," vol. iv) wrote: "It is probable more men have sustained the most melancholy of all mutilations during the four years of war in Portugal through this disease, which was called the 'black lion,' than the registers of all the hospitals in England could produce in the last century." He attributed the severity of this affection to the free sexual intercourse of persons of different nations.

How far this phagedæna depends upon some peculiar power of the infecting poison, or upon the constitution of the individual patient, it is difficult to determine; the latter probably has the greater influence. When any depressing agency is present, such as that caused by drink, excess of venery or illness, phagedæna is more likely to occur than when no such exists.

TREATMENT.—Opium, tonics, and good living are the three essentials in the treatment of all cases of phagedæna; mercury and the iodide of potassium are inadmissible.

Locally, the part must be kept clean by frequent ablution, and to this end the prepuce often requires to be slit up. Lotions of nitric acid, one part to five of water; of carbolic acid, one part to thirty; of sulphate of copper, five or ten grains to the ounce; of potassio-tartrate of iron ten to twenty grains to the ounce, are also useful, and opium in solution is often a good addition. When the disease spreads local mercurial fumigation is said to be of value; but change of air is most beneficial.

Adenopathy or Bubo is a common complication of the simple as well as of the infecting chancre; that is, it is found in the local venereal sore and in the inoculation of true syphilis. In the former, however, the gland, as a rule, suppurates; in the latter rarely, at any rate as a consequence of the local sore.

"Lymphatic absorption," writes Lee, "from a suppurating syphilitic sore (simple) necessarily produces a suppurating bubo; any attempt to prevent such an affection from suppurating is entirely futile. The disease within the lymphatic system is the same, and runs a similar course as that upon the surface of the body." The bubo is the direct result of the absorption of the specific pus; the matter in the interior of the gland retains its specific characters, whilst that outside the gland is ordinary non-specific pus. As

the disease advances, the two fluids mix, and thus the whole acquires the characters of the specific fluid, and in this way the surface of the sore about the glands will become inoculated. These observations apply solely to the simple sore.

In the infecting chancre or chancre of syphilitic inoculation induration of the inguinal glands without suppuration is the ordinary rule; although in exceptional cases, where the sore is a source of local irritation, suppuration of the glands may take place, and during the course of the constitutional symptoms the suppurating bubo is no rare event. The presence or absence of suppuration in the inguinal glands is not, therefore, evidence of any positive value as to the existence or non-existence of a syphilitic affection. It may, however, be stated that a local sore on the penis with an adenopathy passing rapidly on to suppuration in all probability is a local affection and not a syphilitic one. A local sore with a simple induration of the glands is in all probability a syphilitic inoculation.

In every form, therefore, of chancre, although more frequently in the local sore, simple adenitis or sympathetic bubo may be met with as a result of local irritation, and this differs in no respect from the adenitis of any other local origin. One or more glands may be involved in the action, and suppuration may be acute, subacute, or chronic. In the simple local sore it is usually acute. As a rule, however, the sore formed by the venereal bubo, unlike that resulting from simple adenitis, instead of healing kindly, often takes on very much the appearance of the local disease; the edges ulcerate, the opening enlarges, and a large sore is formed; indeed, from this action, the *serpiginous* sore to which allusion will be made, often takes its origin. At times the bubo puts on a phagedænic action and spreads fearfully.

In the infecting and syphilitic chancre the enlargement of the glands is usually indolent; it appears within the first or second week of the inoculation; many glands are usually involved, forming hard, indolent, painless swellings; they rarely suppurate unless the sore is a suppurating one, the powers of the patient are very feeble, or over-exercise or some local irritation excite sympathetic action.

In rare cases the glands are said to enlarge without any local lesion, this chronic enlargement being followed by syphilis. I have, however, never seen a marked instance of it, and in reputed cases have suspected the former existence of some overlooked local sore or fissure. Mr. Cock does not recognize the affection.

TREATMENT.—There is nothing to be gained by suppuration of the inguinal glands, for even when associated with syphilis, the poison is not eliminated by such means, and when from some simple local source of irritation it is only an additional cause of annoyance.

To endeavor to prevent suppuration is, consequently, a wise attempt, and this is the best done by rest and the local application of cold in the form of ice in a bag, or lotions of lead, muriate of ammonia, or spirit. When suppuration is threatening or cannot be retarded, warm fomentations are the best, and as soon as pus has formed a free incision should be made, followed by warm water-dressing or a poultice. A vertical incision is, as a rule, the best, but when the abscess is large the opening should be made in the long axis. The application of leeches or iodine to a bubo that threatens to suppurate seems a useless practice.

In the indolent bubo, or rather the indurated glands, no local treatment is called for; the surgeon should, however, see that no local source of irritation is added to that of the sore, and no excess of exercise by which the inflammation may be increased.

When the cellular tissue around the glands is infiltrated with inflamma-

tory products, as indicated by its brawniness, &c., the value of local pressure by means of a pad and the spica bandage (Fig. 180) is unquestioned; while tonics, rest, and other constitutional treatment are of value. The local application of some mercurial ointment at times appears to be of use, and a small blister—strong solution of iodine or of the nitrate of silver—is of value in hastening either the absorption of the inflammatory products or their suppuration. As soon as suppuration appears, the abscess should be opened. When a hard gland is left at the bottom of a suppurating wound, the American practice of applying some caustic, such as the potassa fusa, to its centre, in order to cause its death and subsequent sloughing, is at times of great use, this practice being as useful in syphilitic cases as in others, whether of inguinal or other glandular enlargements. In some instances the removal of the gland by the scalpel may be expedient. Sinuses must always be laid open when possible.

When phagedæna attacks a bubo, besides opium, tonics, and other constitutional treatment, the local application of nitric acid, or the actual or galvanic cautery, is sometimes called for, more particularly when it spreads in spite of general or other local treatment.

CHAPTER LXIII.

SYPHILIS.

SYPHILIS is a constitutional disease, the result of a specific animal poison introduced from without. Like other specific animal poisons, it is, as a rule, the result of some local inoculation; but, unlike most others, it has the peculiar power of affecting the unborn fœtus and the newly-born child in a direct way from the parents. No other blood poison appears to possess this power, at any rate to the same degree, and it is important to bear this great point of difference in mind, for in all other respects there is a strong analogy between all.

The poison once introduced into the system, either by inheritance—*inherited syphilis*—or by some local inoculation—*acquired syphilis*—manifests its presence in its own peculiar special way, by the appearance of a somewhat irregular although characteristic chain of symptoms. These are uncertain in the period of their appearance after the inoculation, in the order of their appearance, in their form and in their effects, yet they possess their own peculiar features. They are local and general. They run their course, yet do not eliminate the poison. They may disappear for a time to reappear in some other form. The poison may lie dormant for years, and in healthy subjects put in no appearance of its presence till some weakening influence has depressed the powers of its possessor, and given rise to some local affection in which the practiced eye will read with more or less certainty the modifying influence of an antecedent syphilitic affection. The poison for a time has been scotched but not killed, and in the weakness of its possessor has reasserted its power.

No other animal poisons appear to have such tenacity of existence. They produce their specific effects in a definite way and in a regular series of symptoms, and are either eliminated or destroy life; but having made their mark and run through their course, they cease to act and are innocuous, their power for harm being exhausted. The poison of syphilis, however, is

so subtle that it is tolerably certain most of the secretions of a syphilitic subject are capable of producing the same disease in another; clinical experience having disproved the opinion of Hunter that syphilis could only be propagated by the secretion of a primary sore, or the proposition of Ricord, that "a chancre at the period of progress is the *only* source of the syphilitic virus." Indeed, it may fairly be asserted that a healthy woman marrying a man who has had syphilis, after all symptoms have long disappeared, may give birth prematurely to a dead foetus, to a stillborn child, or to an infant that will either at its birth or within a few weeks subsequently show symptoms of syphilis, all these results being the effects of syphilis transferred from the father. When both parents are similarly diseased the evidence is still stronger. "The semen of a diseased man deposited in the vagina of a healthy woman will, by being absorbed, and without the intervention of pregnancy, contaminate that woman with the secondary form of the disease, and that without the presence of a chancre or any open sore either on the man or the woman." (Dr. Porter, "Dublin Journal of Med. Science," 1857.)

A healthy woman marrying a man who has had syphilis, but who has lost all symptoms of it, may acquire syphilis through a blighted ovum, or a series more or less prolonged of stillborn children, the placental circulation between the foetal and maternal blood being the infecting medium.

A healthy woman giving suck to a child the subject of hereditary syphilis may acquire the disease through some fissure of the nipple, the disease locally and constitutionally manifesting its presence with all the intensity of a primary inoculation.

Again, the secretion of any true syphilitic sore, chancre, mucous tubercle, whether of the mouth, nose, anus, vulva, or penis, is capable of transferring the disease; and the syphilitic poison may probably be simply absorbed by the vessels of a part—*physiological absorption*—without giving rise to any local affection. Hunter believed this, and Lane, Marston, and Lee, have published observations that tend to support the theory.

Further, the vaccine virus taken from a syphilitic child possesses power in itself of propagating the disease. "It should never be forgotten that it is the virus which infects the system, and that the sore is the mere local lesion, and not a necessary antecedent to infection." (Committee on Syph., p. 8.)

It should never be forgotten that syphilis, introduced into the system in whatever way, whether inherited or acquired from primary sores, or from the secretions of a syphilitic subject, is the same poison, and manifests its presence in much the same way.

It is sometimes difficult in individual cases to make out the direct source of the contagion; but recognizing the fact that the virus, however diluted in one subject, may in another show itself in all its power, as if, in fact, taken from a primary sore, the explanation of most clinical facts becomes easy.

Syphilis is an animal and a human poison; it is capable of propagation from the secretion of any syphilitic to a virgin subject in all its intensity, by some form of inoculation, or by inheritance. Nothing is known of its nature, although much of its effects. The syphilitic virus, writes Bumstead ("Venereal Dis.," 1870), is alone capable of infecting the system at large, and of affording protection by its presence against subsequent attacks. Unlike the poisons of gonorrhœa and of the chancre, it is not limited to purulent matter, but exists in the blood, in the fluids of secondary lesions, in the semen, and probably in other secretions.

How, then, it may be asked, is syphilis to be recognized? Is it to be

recognized in its primary inoculation, or is it only to be known by its constitutional symptoms?

It has been already stated that most authorities are agreed upon the fact that there is no form of local sore, chancre, or inoculation, that can be said with certainty to be the inoculation of syphilis. In the cartilaginous indurated sore, with enlarged glands, there is every probability of syphilis manifesting its presence by constitutional symptoms; and in the multiple, suppurating, non-indurated chancre, there is every probability of no such symptoms appearing. But in the first form no symptoms of the kind may appear, and in the second they may. Consequently, as a law, this distinction becomes of little value. Indeed, syphilis as a disease can only be known by the manifestations of its constitutional symptoms, and not by the local inoculation; in the same way as small-pox, when propagated by inoculation, is only to be recognized by the eruption, and not by the local appearances resulting from the inoculation.

Acquired Syphilis.—Acquired syphilis is always contracted through inoculation—the inoculation from a local chancre or sore—the inoculation or some discharge from a syphilitic mucous tubercle, condyloma, or other sore, or even from the secretions of a syphilitic subject; the secretion of any syphilitic sore from one subject being capable of producing in another a chancre of any form.

After inoculation a certain time usually elapses before the poison manifests its presence, this period varying from six weeks to three months. In exceptional cases the symptoms of syphilis may appear within the month, or fail to appear for four or more months, but every week that passes after the third without their manifestation lessens the prospect of their appearance, and when six months have gone over without their putting in an appearance, the probabilities of their doing so are very slight.

The different forms of syphilitic inoculation have been considered under the head of chancre, &c.

Dismissing, therefore, the consideration of the inoculating medium, and the character of sore to which syphilis usually gives rise, with the simple reminder that there is no positively specific sore, the constitutional symptoms of syphilis will now claim attention, and the variety of forms they assume are very striking. They usually show themselves primarily upon the skin in the form of an eruption, or upon the mucous membrane of the alimentary canal, as indicated by sore throat, while some amount of fever and constitutional disturbance usually precede their appearance.

The skin eruption may be only a rose rash, *roseola*, giving rise to a mottling of the skin, or a more lasting staining. It may assume the papular form, *lichen*; the pustular, *ecthyma*; the vesicular, *rupia*; the tubercular, ulcerating or non-ulcerating; or the scaly, *lepra* or *psoriasis*. Bullæ are rare, except in hereditary disease; when present they indicate a cachectic condition.

The mildest form of *roseola* may last but a few days and disappear, or leave a dusky coppery stain behind of some durability.

The *lichen* will soon show the copper tint, and, as it flattens down, may become a tubercle, and this a scale, the skin on the desquamation of the scale showing much the same appearance as the macula of the rose eruption.

When the eruption is tubercular at the first, the same series of changes will be seen; the raised, indurated, or spongy tubercle, as it withers, usually showing a scale upon its surface, and flattening down to a macula.

The *lepra* and *psoriasis* appear as inflamed patches, more or less extensive, as in ordinary disease, the epithelial scales varying in thickness, and

the fissures in depth. The psoriasis commonly appears on the palms of the hands and soles of the feet.

All these eruptions have a copper tint, more particularly after their first appearances have faded, but what is still more characteristic, is the fact that upon the same subject several forms of eruption are often found together—the macula, papule, pustule, tubercle, and scale, passing one into another.

What it is that determines the form of the eruption at its first appearance is not known. Why syphilis in one man should manifest its presence by an eruption of mere maculæ, in another by a papular or scaly eruption, and in a third by a pustular, tubercular, or ulcerative form, is not known. The theory propounded by Carmichael, that each form of eruption has its own form of local sore or inoculation, was ingenious, but not supported by facts, and the generally received opinion is that the peculiarity or power of the infected patient has more to do with these phenomena than the nature of the poison itself. In cachectic subjects the pustular and vesicular eruptions are more prone to appear than in the robust, and an ulcerative action is too often found to accompany, or rather to follow, their appearance; the base of the pustule or of the vesicle, and at times the substance of the tubercle, breaking down, and giving rise to a troublesome and spreading ulcer.

As the *outside skin* is attacked by eruptions, simple and ulcerative, in syphilitic subjects, so the *inside skin or mucous membranes* are equally involved. "Every form of syphilitic affection of the skin," writes Lee, "has its counterpart in the mucous membrane; but the appearances will be modified by the comparative thinness of the structure, by the absence of cuticle, and by the little disposition these parts have to take on the adhesive inflammation." The mucous tubercle is the more common form, as found in the organs of generation, tongue, mouth, lips, nose, palate, throat, rectum, and anus, and occasionally in other parts of the alimentary canal. It is known also in the larynx. At times these tubercles break down and ulcerate, giving rise to irregular excavated sores.

When these moist tubercles appear between the toes they are known as *rhagades*. They may appear at any part of the body in syphilitic subjects, where two skin surfaces are in contact associated with moisture. The same tubercle in the skin about the orifice of mucous passages is known as a condyloma.

Syphilitic Sore Throat may be a mere mucous patch upon its surface; at times it is an ulceration of this patch, but at others it is a distinct affection, the throat becoming swollen and of a livid color, and rapidly passing into ulceration. These ulcers may attack the soft palate, pillars of the fauces, tonsils, or pharynx, and present every kind of appearance, shape, and character. They may be serpiginous like the trail of a snake, horse-shoe shaped or circular, superficial or excavated with sharp edges, inflamed, sloughing, or indolent. By themselves they are not typical of syphilis, however suspicious, and require other concomitant symptoms to determine the diagnosis.

The mucous patch is the most characteristic. No ulceration is typical; the sharply cut excavated ulcer is the most so.

In hereditary syphilis this form of excavated ulcer is rare, but I have seen the perforating ulcer of the soft palate in an infected infant a month old.

Syphilitic Disease of the Tongue is one of the most troublesome forms of the affection, and presents vast variety in its manifestation. The aphthous and mucous patches, ulcerating or otherwise, are the more common, but

not unfrequently the whole thickness of the organ is infiltrated with the gummatous syphilitic material, either as an isolated nodule or as a general infiltration. When this nodule has softened down and suppurated a deep excavated sore or fissure may be left, not unlike that of cancer, and when this is sloughing or of a chronic nature the diagnosis is still more obscure. In cancer, however, there is probably a more marked local induration than in syphilis, and rarely a sharp, well-defined edge. The history of the case is, moreover, different.

The mucous lining of the mouth, lips, nose, &c., is also equally liable to syphilitic disease, either in the shape of aphthous and mucous patches or of ulceration, not unlike that found on the throat or tongue; indeed, the disease of one part of the mucous membrane is the same as that of all others, the local appearances and symptoms being modified only by the peculiarities of the part.

In ulceration of the rectum syphilis bears an important part. As a cause of stricture it is not rare; when present, the disease usually spreads upwards from the anus, the bowel being in some cases superficially, in others deeply infiltrated and ulcerated. This form of disease is more common in women than in men (*vide* chapter xxxv, p. 362).

Syphilitic Disease of the Periosteum shows itself in the form of nodes, rarely as a single node. If the tibia be involved several swellings exist, and the same of other bones, particularly of the cranium, the swelling being merely an effusion of the gummy material beneath the periosteum. When the bones are attacked the disease is mostly chronic, and too often ends in death of the part, or necrosis.

In disease of the periosteum extreme tenderness and pain, with local swelling, are the chief symptoms. When the bones are implicated the pain is of a constant aching character, and this is always aggravated towards night, but there is not such swelling as in the periosteal affection, or so much tenderness. In disease of the bones of the skull the dura mater and brain may become secondarily affected.

It must not be thought, however, that syphilis and its effects are confined to those parts of the body that come under the immediate notice of the surgeon; it is hardly probable that both ends of the alimentary canal should show evidence of the affection without some part of its intermediate twenty-five feet being implicated, or without some of the compound glands that are associated with it being involved. The pathologist knows this to be the case, and modern science has confirmed Wilks's observation ("Guy's Reports," 1863), that "the extent of the influence of syphilis is only commensurate with the tissues of the body," and "there appears to be scarcely a tissue which may not be affected, and always in one particular and characteristic manner." "The internal organs may be affected equally with the external; not only the cranium, but the brain within it, or the nerves; not only the muscles of the limbs and tongue, but the heart; not only the pharynx, but the œsophagus; not only the larynx, but the trachea, bronchi, and lungs, also the liver, spleen, and other viscera."

"**The peculiar effect of syphilis on the system,**" says the same writer, "shows itself in a disposition to the effusion of a low form of lymph, or fibro-plastic material, in nearly every tissue of the body, occasionally modified in character to a slight extent by the organ in which it occurs. In solid organs or in the interior of the tissues there is found a more or less circumscribed deposition of an albumino-fibrous material, whilst on the surface of the body a similar material may constitute merely the base and border of an ulcer." In the testicle this is well seen (Fig. 283).

In these observations the whole pathology of syphilis is included, for

whether syphilis involve skin, mucous membrane, cellular tissue, muscle, bone, periosteum, or a viscus, the same exudation exists, either as an exudation and induration, or as an exudation breaking up with ulceration.

This exudation is the same in all stages of syphilis, in all tissues in hereditary as in acquired syphilis. When the exudation is reabsorbed a recovery is said to have taken place; when it breaks down, suppuration ensues. When it attacks the external tissues secondary symptoms are said to exist; when the internal viscera or the bones are affected, the symptoms are called tertiary.

In cachectic and feeble subjects, where visceral mischief is prone to appear, syphilitic disease of the organs may occur. The bones, if affected, are liable to become necrosed; the larynx, to ulcerate; the skin, to suppurate and ulcerate. In fact, syphilitic disease in the feeble and cachectic is as liable to be associated with disorganizing changes as any inflammatory or other affection. The longer the disease has existed also, the greater the probability of the viscera and the tissues of the body generally being involved.

But in all other respects the effects of syphilis are the same. The virus, as it affects the body in all its different ways, is the same; at all times it is the same. The so-called secondary and tertiary syphilis are the same, for these terms have no definite signification; they have, doubtless, tended to confuse the subject rather than clear it. They were framed when the pathology of the disease was poorly known. They should be discarded now they are known to have no definite meaning. Syphilis is clinically known by certain constitutional symptoms, and pathologically by certain morbid conditions. It may differ in different subjects in the way it manifests its presence, involving now one tissue, now another. The bones in one patient may be involved early, in another late, no apparent law regulating its action, but in all its pathology is the same. The node on a bone, the nodule of lymph on the iris, the indurated gummy tumor in the cellular tissue or in a muscle, the puckered nodule of fibrous tissue beneath the peritoneal covering of the liver, the mass of fibre tissue poured out in a syphilitic testicle, are all alike. They differ only in their symptoms and effects according to their position, but whether they occur soon or late after the primary inoculation is a matter of no clinical importance.

"While syphilis is thus unsparingly general in its attacks upon organs, yet it plays over much the same series of organs as other diseases; vulnerable or much-abused organs, which suffer disproportionately from common causes of disease suffer also in much the same proportion from syphilis, while the thyroid, spleen, capsules, deep-seated bones, and, indeed, generally those parts which are not obnoxious to other 'common' diseases, escape also in syphilis" (Moxon, "Med. Times," June 24, 1871). In fact, beyond the local inoculation syphilis fixes or rather attacks an organ much as any other disease, it has no special predilection for one in preference to another, or for one tissue; the so-called secondary and tertiary affections have no real difference, they exist only in the surgeon's mind.

TREATMENT.—There is no remedy in the Pharmacopœia that can be looked upon as a specific for syphilis, although there are many that have a very beneficial influence in aiding the disappearance of the symptoms;

FIG. 283.



2351⁸⁸. Prep. Guy's Hosp. Mus.
Half the testicle only drawn.

they can, however, do no more; they do not cure the disease. Indeed, it is a question whether the disease is really ever cured, whether a man who has been once under the influence of syphilis is not really like another who has been brought under the influence of vaccinia, that is, his body has been so affected by the poison as to be influenced for life. After a successful vaccination a second inoculation rarely takes as it does in a virgin subject, and after true syphilis a second attack rarely if ever ensues, Porter's law being tolerably proved, "that the influence of syphilis never returns upon itself, or recontaminates the source from which it had been derived" ("Dublin Quart.," 1857). Ricord, Lee, and others have proved that the soft or non-infecting chancre is the only one that can be inoculated with success on the same subject. It is true that in a large number of cases syphilis appears to be cured, the symptoms disappear and the health of the patient is re-established, but it is equally true that in such cases, after the lapse of years, even a quarter of a century, under some weakening influence by which the powers of the patient are reduced, and some local disease, such as an ulcer, appears, the existence of former syphilis is to be recognized.

As long as the powers of the subject who has had syphilis remain good, no evidence exists of its presence; when they fail, the poison reasserts its claim to recognition. It may, however, be stated with some confidence that nature, unassisted by art, seems incapable of eliminating the disease or of arresting its progress.

In former times the surgeon thought that in mercury he possessed a specific against the disease, and when all chancres were looked upon as syphilitic, and mercury was given, a large proportion of supposed cures were recorded, no constitutional symptoms showing themselves.

In modern times, when it is known that at least three cases out of every four of chancres of the penis are local venereal affections, and not syphilitic, the supposed success of the mercurial plan is not recognized, although in syphilis—that is, when the constitutional evidence of the disease is present—the power of mercury in getting rid of the symptoms is indisputable.

In strong and hearty subjects, therefore, when syphilis is present, either in the form of skin eruption, sore throat, or other affection of the mucous membrane of the intestinal or respiratory tract, mercury is good. The best way of using it is by inunction, the rubbing in of a piece of mercurial ointment, the size of a nut, into the axilla twice a day, till the gums are touched, and then once. Dr. B. G. Babington advised its being applied in adults to the soles of the feet, the rubbing in being carried out during the friction of walking. The internal administration of the bichloride of mercury in doses of $\frac{1}{16}$ th of a grain in bark, three times a day, is a good formula for administration, as is also the green iodide of mercury in grain doses twice a day, with Dover's pill. Some surgeons still use the blue pill with opium. During the last three years I have been using the mercurial suppository twice a day, and have been much pleased with its action; indeed, I am disposed to think it by far the best mode of administering mercury; it acts as well as by the mouth, and in no way interferes with digestion or the functions of the abdominal viscera. I know of no single objection to its use. Next to this plan the calomel vapor bath is the best. Mr. H. Lee is its greatest advocate.

The most convenient calomel vapor bath, writes Lee ("Holmes's Surgery," ed. 2d, vol. i), is one which was made at my request by Mr. Blaise. In this apparatus the lamp which sublimes the calomel boils the water at the same time. In the centre of the top, immediately over the wick of the lamp, is a small, separate, circular tin plate, upon which the calomel is placed; around this is a circular depression, which may be one-third filled

with boiling water; the apparatus is then placed on the ground and the lamp is lighted. The patient sits over it, with an American cloth cloak or mackintosh fastened round his neck. He thus becomes surrounded by calomel vapor, which he is generally directed to inhale for two or three separate minutes during each bath. In doing this the patient should not put his head under the cloak, but simply allow some of the vapor to escape from the upper part, and breathe it mixed with a large proportion of common air. At the expiration of a quarter of an hour or twenty minutes the calomel is volatilized and the water has boiled away—a portion of the calomel is deposited on the patient's body. The patient may then gradually unfasten his dress and put on his night dress; he must not wipe his skin. He may go to bed if he likes with the cloak and wear it. The bath should be used every night and five or ten grains evaporated.

Recently Bricheteau, Lewin, and Sigmond have employed the hypodermic injection of mercury with some success, throwing in 15 minims of a solution of corrosive sublimate, 4 grs. to the ounce of water. ("Brit. Med. Jour.," 1869.)

For feeble cachectic subjects mercury, however, is ill adapted, and to these the iodide of potassium in five-grain doses, gradually raised to ten, will do all that is wanted; in London practice it is generally required to be combined with some tonic, such as bark, the quinine mixture, or the iodide of iron. At times the combined use of mercury and the iodide of potassium is of great value.

When the mucous tracts are involved the addition of some alkali, such as the bicarbonate of potash, in ten-grain doses, to the iodide is of great value. The addition of the compound spirit of ammonia to the bark mixture is useful.

When the symptoms begin to go the treatment must be continued; indeed, the effects of the drugs, whatever they may be, should be kept up for at least a month after the disappearance of all symptoms, otherwise a speedy relapse will take place.

Comparing the two drugs together, it may be stated that the mercurial plan of treatment is more applicable to the early symptoms of syphilis than the late; that in those of relapses, or of a remote kind, the iodide of potassium is the better drug, although under both circumstances, in exceptional cases, one plan of treatment will succeed where another fails.

During the course of a syphilis the patient should live well, upon simple, nutritious, but non-stimulating diet; wine and beer should be given in moderate proportions; spirits should not be allowed; smoking also is bad.

When mercury is being employed the skin should be kept warm and the feet dry, all sudden chills being bad. When suppuration or ulceration exists in any form of syphilis, mercury is rarely applicable; the iodide of potassium combined with tonics is then the best drug, with or without opium. Sarsaparilla has no specific influence in syphilis; it is a pleasant vehicle, but nothing more. Opium combined with other drugs is at times of great value; with mercury it is invaluable; it may be given in small doses whenever the nervous system has been overwrought and great irritability of pulse is present. "The soothing qualities of this admirable medicine," writes Pearson, "can scarcely be estimated too highly." In spreading ulcerations, whether it be due to local disease, or the expression of a constitutional symptom, opium is invaluable, either given alone or combined with the iodide of potassium. In spreading ulcerations mercury is rarely beneficial.

The syphilitic affections of the mouth, tonsils, throat, tongue, &c., are expedited in their disappearance by the local application of the nitrate of

silver, chlorate of potash, or borax lotion, while constitutional treatment is employed at the same time.

The **mucous tubercles** of the genitals and other parts are most successfully treated by the local application of calomel, the drug being dusted over the diseased surfaces through a muslin bag. A good rub with the nitrate of silver at times expedites the cure. The parts should be kept well dry.

Condylomata are not so amenable to the calomel treatment as the moist tubercles; they may, however, be successfully treated by the local application of the nitrate of silver or sulphate of copper, a lotion of the bichloride of mercury, gr. ij to the ounce of water, or of black wash. When very fleshy, excision is the best practice.

In **ulceration of the throat** full doses of the iodide of potassium are of great value, say six to fifteen grains, three times a day, with the local application of the nitrate of silver in stick or strong solution, and alum, chlorate of potash, or borax gargle, a drachm to the pint of water.

In **laryngeal disease** the iodide must also be given equally freely; and when ulceration has commenced, and seems to be unaffected by general treatment, the subject of tracheotomy claims serious consideration, for unless the organ of voice and respiration can be kept quiet, repair will not go on, and as long as progressive ulcerative disease exists, a sudden spasm of the larynx is imminent and also the death of the patient. The operation should, however, only be undertaken when the disease is steadily progressing in spite of treatment, and it is clear that the larynx will be destroyed as a vocal as well as a respiratory organ unless some steps be taken to stop its progress, and of these steps there are none equal to tracheotomy, for all surgeons are familiar with the fact that even under the most extreme conditions of disease repair goes on in the larynx directly the tracheal tube has been introduced, and physiological rest is given to the organ (*vide* paper by author, "Clin. Soc. Trans.," 1868).

In the **gummy tumors** of the tongue, muscles, and cellular tissue, large doses of the iodide with tonics are of great value; and there is reason to believe that the drug is of equal benefit when the viscera are involved, for in syphilitic disease of the testicle its benefit is daily witnessed, as well as in some cases of cranial disease; and in the viscera the changes are the same.

In the **periosteal** affections following syphilis the same practice is of value.

There is reason, however, to believe that in the visceral, as well as other diseases, that may be looked upon as the sequelæ of syphilis, or as being the result of the cachexia caused by the disease, and the remedies employed for its removal, the iodide of potassium has little influence, for Dr. Wilks has shown how the lardaceous and waxy diseases of organs are found after syphilis, and every one knows how little amenable to treatment these affections are, although Dr. Dickinson has done something to prove that these conditions are due to a want of alkalinity in the blood, and are to be prevented, and in a manner cured, by the medical use of alkalies.

It is to be remembered that in syphilis the **gummy** products of the disease may involve the bones with their periosteal coverings, the muscles with their cellular-tissue surroundings, and the integuments, including even the nails, hair, &c.

That the glands and viscera may not only be similarly involved, but may, as a result, undergo a waxy or lardaceous change.

That in the gummy period of the disease, whether it be visceral, osseous, glandular, or otherwise, the iodide of potassium in full doses is of great value. In the sequelæ, in waxy or lardaceous disease, it is of little use, alkalies with tonics being apparently the best. Upon this knowledge it is

probable that the late Mr. Aston Key, in the syphilitic cachexia, was so fond of lime-water and the infusion of sarsaparilla.

Hereditary Syphilis.—That syphilis is capable of being propagated by hereditary transmission is a clinical fact generally recognized, and in it is found the main distinction between syphilis and all other animal poisons. How far this influence spreads is still a question under discussion; according to some observers, instead of diminishing, the radius of its action appears to be yearly increasing.

That the child of a parent who has had syphilis *may, not must*, inherit the disease is generally accepted, and when both parents have been affected the probabilities of its transmission are, doubtless, strengthened; but data are still wanting to determine under what circumstances the offspring of such parent or parents is likely to be thus affected, or to be born healthy, and whether maternal or paternal influence is the greater.

There is, however, some reason to believe that when the mother is at fault the early conceptions are more likely to be blighted, and the later ones come to maturity; whilst when the father is at fault the first show few, if any, signs of the affection, the symptoms becoming more marked in each succeeding one, till at last the ovum becomes blighted, and the wife constitutionally affected.

Daily experience, however, proves that a man who has had syphilis and lost all traces of it under treatment, who enjoys good health, and marries a healthy wife, may be blessed with healthy children, in whom no traces of syphilis can be found; and the same experience also indicates that like subjects, marrying in a less vigorous condition of health, or lapsing into it, may give rise to diseased offspring. The probabilities of the child being affected, and the degree of the affection, turn much upon the period of time that has elapsed between the disappearance of the constitutional symptoms in the parent and marriage.

These clinical facts dovetail in with another *fact*, that syphilis, having run through its early course, may remain latent for years—even a quarter of a century—and then manifest its presence by some cellular membranous ulcer, or other local affection, in subjects whose powers have been reduced by any cause.

A certain number of children, writes Lancereaux, succumb in their mother's womb to syphilis, solely because they are already affected with the disease; at other times, the children come into the world with lesions unmistakably syphilitic; whilst in the great majority of cases the child who inherits syphilis has at first the appearance of health, and, some weeks afterwards, presents signs which betray the evil transmitted to it from its parents, and it is usually from the first to the third month of extra-uterine life that syphilis manifests itself in the new-born child. Cullerier, however, gives a year as the latest time for the disease to show itself.

With respect to the symptoms of hereditary syphilis it may be well to assert at the beginning that, with the exception of the primary inoculation, they are much the same as those of the acquired disease. Affections of the skin are found associated with affections of the mucous membranes, bones, or viscera; and these affections show themselves in no definite order.

At birth the child may be plump and fat, and for some days appear healthy in all ways. After the lapse of a few days some difficulty in breathing will probably appear, with symptoms of cold in the head, and these "*snuffles*" are always suspicious. At this time, if the skin be carefully examined, more particularly about the buttocks and feet, some eruption will be seen. This eruption may be simply a staining of the skin, or a more definite papular, vesicular, or pustular rash; it may be associated

with some affection of the internal skin or mucous membrane, mucous patches, or condylomata showing themselves at the anus, about the mouth or within it, around the nose, or other parts. The seat is much determined by the amount of cleanliness observed, the irritation of dirt in syphilitic children being generally followed by condylomata or mucous patches.

The orifices of the nose, mouth, and anus, are at times fissured in a very marked manner, and at times exhibit manifestations of the disease which can never be mistaken, even years afterwards; in the drawing below these alterations about the face are most typical (Fig. 284).

When the disease is allowed to run its course the child's general condition suffers; it becomes emaciated and puny; its digestive organs become deranged, and refuse to assimilate the food, however good, that is poured into them; vomiting and diarrhœa are common consequences. Evidence of starvation soon appears; the skin becomes baggy, and of a peculiar dusky hue; when not covered or scarred with eruptions it may have a jaundiced appearance, and the child will probably die from what is called marasmus, which means wasting from starvation, the organs refusing to do the work demanded of them.

When the disease does not run so rapid a course other symptoms show themselves. It may be in the skin, bones, eye, ear, or viscera.

In the *skin*, or subcutaneous, or submucous tissues, they may appear as *gummy swellings* or *tumors*, and these may break up and give rise to irregular excavated cellular membranous abscesses. In the *bones* they may show themselves as nodes, and the humerus appears to be the bone the more commonly affected. I have, however, seen several instances in which the bones of the skull were frightfully involved.

In the eye they are well known; the *interstitial keratitis*, a form of disease, according to Hutchinson, which is peculiar to hereditary syphilis, generally shows itself between the ages of eight and fifteen years. It appears as a diffused haziness of the centre of the cornea, unattended with ulceration; this haziness begins in independent patches, which subsequently coalesce, the cornea, at a later date, appearing like ground glass. The affection is attended with photophobic pain about the orbit, and sclerotic injection. It generally involves both



Hereditary syphilis, from life.

eyes seriatim. Under treatment the disease may be arrested, but when severe, patches of haziness remain which interfere with vision, at times causing complete blindness. (Fig. 284.)

Iritis is also another complication although a rare one, and *choroiditis* and *amaurosis*.

Deafness is not infrequent, the hearing failing without any external disease, no otorrhœa, the patient simply becomes deaf. In most cases both ears are affected.

Hydrocephalus and syphilis are also allied. *Syphilitic* disease of the testicles is also met with. I have seen several such cases, the most marked was in a boy four months old, who had snuffles and mucous patches on the lips. Each of the testicles was one and a half inches long and very hard.

The disease was cured by mercurial treatment. He was the third child of syphilitic parents.

Indeed, there is reason to believe that in hereditary, as in acquired syphilis, every organ of the body in different cases may be found diseased; the viscera of the cranium, thorax, and abdomen, with the glands generally, also the skin, mucous membrane, muscles, nerves, and bones.

How far the syphilitic poison follows the subjects who inherit it is a difficult question, for it is not an uncommon event to find a child entirely free from all evidence of such a poison born of parents who had previously given birth to stillborn or diseased offspring, and in some cases even followed by a like series. A healthy child may stand alone in a long series of conceptions, a living proof of the power of life even over such a poison as syphilis.

I have also before me the notes of an instance of twins born of syphilitic parents; one went through all the series of complaints common to hereditary syphilis, and the other escaped altogether, that is, at the end of a year and a half no symptoms had appeared.

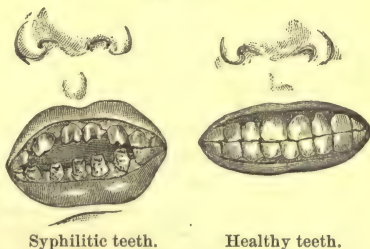
I have the notes of another case of twins, born under like circumstances, in which the symptoms appeared in one at the end of a month, and in the other at the fourth month.

Such cases as these would appear to show that the manifestation or non-manifestation of the symptoms of hereditary syphilis depends much upon the personal power of the child who inherits it, a strong child throwing off or eliminating the poison, while a weak one falls under its influence; for in the case of twins mentioned there can be no question as to the similarity of conditions under which they were placed. In hereditary syphilis this conclusion is founded upon strong evidence, and in the acquired it is at least as probable.

Amongst the evidences, thanks to Mr. Hutchinson, of hereditary syphilis there are often present in the permanent teeth important indications, so important, indeed, that when they are present the existence of hereditary syphilis may with some confidence be pronounced; they, however, exist only in exceptional instances of hereditary syphilis. "*The central upper incisors of the second set are the test teeth;*" these teeth are usually short and narrow, with a broad vertical notch in the edges, and their corners rounded off (Fig. 285); horizontal notches have nothing to do with syphilis.

"Next in value to the malformation of the teeth," writes Hutchinson, "are the state of the patient's skin, the formation of his nose, and the contour of his forehead; the skin is almost always thick, pasty, and opaque. It also shows little pits and scars, the relics of a former eruption, and at the angles of the mouth are radiating linear scars, running out into the cheeks. The bridge of the nose is almost always broader than usual and low, often it is remarkably sunk and expanded. The forehead is usually large and protuberant in the regions of the frontal eminences; often there is a well-marked broad depression a little above the eyebrows. The hair is usually dry and thin, and now and then the nails are broken and splitting into layers. Interstitial keratitis is pathognomonic of inherited taint, and when coincident with the syphilitic type of teeth, the diagnosis is beyond a doubt."

FIG. 285.



In Fig. 284, page 642, every point in this description is illustrated except with reference to the teeth, which were unusually good.

TREATMENT.—To help the disappearance of the symptoms of hereditary syphilis remedies are of great value, and in an infant that shows evidence of any constitutional power the prospects of a recovery are very good. When the child is suckling, whether the mother shows symptoms or not, I administer my remedies, and have done so for many years, through the mother, giving her from six to ten, or sixteen grains of the iodide of potassium with quinine, or other tonic mixture, three times a day, half an hour before the child is put to the breast, and I have been much struck with the excellent results of this practice.

When this process acts slowly I give the child in addition a grain of gray powder, with three or four grains of dried soda, every night. Before this I used to give the gray powder and soda twice a day, or rub in about ten grains of blue ointment every night on the soles of the child's feet, the abdomen, or the axilla, but I much prefer the practice previously laid down. In young infants the mercurial ointment may be put on the belly-band, and thus rubbed in. As the snuffles disappear, the eruption and mucous tubercles fade, the child will begin to fatten and show signs of progress. The treatment should be kept up for at least a month after the disappearance of all symptoms.

The chlorate of potash treatment in some instances is doubtless attended with no unfavorable result, strong infants with care and nursing battling through the disease and possibly eliminating it. But the weaker ones go to the wall and die, when by more active measures they might probably have been saved; for many apparently hopeless specimens of hereditary syphilis become under treatment strong and healthy infants.

A child with hereditary syphilis should under no circumstances be suckled by any other woman than the mother. When she cannot attend to it, it should be brought up by hand, for many a healthy wet nurse has been inoculated by such a criminal practice.

Serpiginous ulceration is a rare and somewhat singular form of venereal disease; it would seem to be more closely connected with the local suppurating non-syphilitic sore than the syphilitic, for it is rarely if ever associated with constitutional syphilis. It usually appears in the groin or thigh after a suppurating bubo the result of a suppurating non-syphilitic chancre, the opening in the groin spreading in crescentic patches of ulceration, one part of the sore increasing whilst a second is healing, and the cicatrix presenting a smooth glazed appearance. This ulceration is most obstinate, indeed medicine appears to have little or no influence on its progress, and it may so spread as to cover the thighs and lower part of the abdomen, and continue at intervals for years, at last wearing itself out. I have seen one case in which it spread as high as the umbilicus and as low as the knee. The disease at one time promises to heal and then spreads without any clear cause. It is often found in apparently healthy subjects; it seems to follow some course of its own that is not understood. It should be added that this sore is capable of being inoculated upon the same subject, the point of inoculation taking on the same action.

TREATMENT.—Mercury and iodide of potassium appear to have little or no influence on this affection; and if the view indicated by its course be correct, that the disease is not syphilitic, such a result is only what is to be expected. The local treatment of the sore seems to be the most important, and the best practice consists in the local application of some strong caustic, such as nitric acid, carbolic acid, or the cautery, either galvanic or actual, the patient being under the influence of some anæsthetic. Opium in

moderate doses and tonics are of use, but in a general way the subjects of this affection are in good health. In several instances I have found a sea-voyage of more value than any other treatment.

When may a man who has had syphilis marry? is a question which is often put to surgeons, and to answer it with any degree of confidence is no easy task, assuming, as I do, that the opinions laid down in these pages are correct, that a man who has had syphilis once is never free from its influence, and that the poison, once in the body, may reveal its presence a quarter of a century after all external evidence of its existence in the form of local disease has disappeared.

A man who has had syphilis may, therefore, when he marries, so affect the ovum of his wife as to cause its death, or produce some evidence of disease, or some feebleness; or if the mother be healthy and the father in good condition and free from evidence of the disease, the offspring may escape altogether and appear as healthy as those of other uninfected parents. Indeed, it would appear that if a man marries when in robust or good health a year after all evidence of the disease has vanished, he may be the father of a healthy child; but if his general condition fails and he becomes cachectic the poison seems to have the power of reasserting its influence and manifesting its presence by some feeble or even diseased condition of the subsequent offspring.

When the mother is affected with the disease the same risks are run.

Every parent who has had syphilis runs the risk of giving birth to feeble or diseased offspring; these risks are diminished by the general vigor of the parents, they are increased by diminished power. No man should marry as long as the slightest taint of the disease manifests its presence, but if in good health, and free from all evidence of its presence for a year, marriage may be contracted. To ask for a longer delay when such a step is contemplated is unfair and unnecessary; a risk must be run, and the lapse of a longer period will not lessen it.

Inoculation and Syphilization.—Ricord was the first surgeon who employed inoculation for diagnostic purposes in venereal affections; and through his experiments he was led to the conclusion, that "a chancre at the period of progress is the only source of the syphilitic virus." As a test of the simple suppurating sore it may now be employed, for a second sore can readily be obtained by inoculating a patient from the pus of his own primary one. Indeed, this process of auto-inoculation may be continued for a long series, but only from the suppurating sore with any effect. In the syphilitic sore no inoculation will take. And in the inoculation of common pus no reaction occurs, or next to none, a simple pustule probably alone appearing.

From these clinical facts it would appear that common pus, the pus from a suppurating non-syphilitic sore, and that from a syphilitic one, are very distinct, including under the term syphilitic any sore that is followed by syphilis.

By inoculation, therefore, a surgeon may fairly determine the fact as to the nature of a chancre, and under some circumstances the evidence obtained by the practice may be valuable.

Syphilization originated in 1844 in some experiments of M. Auzias Turenne upon animals to inoculate them with syphilis; and in these he found that, after a number of inoculations, they became proof against the syphilitic virus. It was followed up by M. Sperino, of Turin, and extensively employed by Professors Boeck, Faye, and Bidentkap at Christiania, several hundred cases having been treated upon the principle, the object being "to cure syphilis."

The theory as expressed by Boeck, "that the syphilitic virus, by con-

tinued inoculation, annihilates itself," was practically carried out by inoculating a patient the subject of syphilis with fresh matter from any active venereal sore of any kind till the inoculations failed to take. The inoculations were repeated every three or four days, first on the body, then on the extremities. When this result is met with, "the treatment is finished, and the patient has recovered his health."

Boeck never practiced syphilization until the constitutional symptoms appeared, for, says he, "I cannot double a malady already present, so I am quite certain not to do harm to the patient." Syphilization is not used with equal success against all cases of syphilis. "In those that have not been treated with mercury, the progress of syphilization will be regular; the syphilitic phenomena will vanish away, immunity will take place eventually, and recovery be attained with certainty. In those who have taken mercury syphilization is not so certainly useful; it ought to be tried; it does often cure syphilis entirely, and at least does good."

These are Boeck's conclusions; but I need hardly add, they are not those of British surgeons. The practice has been mentioned and briefly described, but not to be recommended; it has no single advantage, and is at least loathsome. We are decidedly of opinion, write Lane and Gascoven, in an able article on the subject, that syphilization is not a treatment which can be recommended for adoption. We consider that, even if it could be admitted to possess all the advantages claimed for it by its advocates, its superiority over other modes of treatment, or in many instances over no treatment at all, would not sufficiently compensate for its tediousness, its painfulness, and the life-long marking which it entails upon the patient ("Med.-Chir. Trans.," vol. 1).

Vaccino-Syphilis.—That syphilis may be transferred by means of vaccination is a fact which must be honestly accepted, although where it has occurred it seems more than probable that something more than the unmixed lymph of the genuine vaccine vesicle had been employed, such as the blood of the vaccinifer; for no one can now well dispute the possibility of inoculating syphilis when the blood of a syphilitic vaccinifer is transferred with the vaccine matter to a non-syphilitic subject. Whether it be possible to transfer syphilis through unmixed vaccine lymph is still an open question. In this country such a misfortune as a syphilitic inoculation through vaccination has happily been rare, and it is only in recent days that the attention of the great body of the profession has been drawn to the subject. In Mr. Hutchinson's paper and in the report of the Med.-Chir. Society for 1871 there will be found sufficient material to prove the truth of what has been written; and in Dr. Seaton's "Handbook on Vaccination," and Dr. Ballard's work, all that is known on the subject may be read.

To guard against the possibility of repeating these errors, the vaccinator should be careful to transfer only the unmixed vaccine matter; we should select also when possible a healthy vaccinifer, and the second child of a woman whose firstborn is healthy, and in whom there be no history of mis-carriages. When any suspicion of syphilis exists in either parent the child of such parents should be set aside and not used as a vaccinifer, however healthy and perfect the vaccine vesicle may be. The cleanest instrument should be used, and the same one should never be employed for a second operation until washed. It would be also well at times to vaccinate direct from the heifer.

With the precautions above given vaccination may be regarded as a perfectly safe operation. Without them the risks of syphilitic inoculation exist, although they are very slight. They tell, however, but little against the enormous advantages of vaccination.

Lee, "Holmes's System," 2d ed., vol. ii.—Marston, "Med-Chir. Trans.," vol. xlv-vi.—Lane and Gascoyen, "Med.-Chir. Trans.," vol. i.—Bumstead, "Edit. of Cullerier," Philadelphia, 1868.—Porter, "Dublin Quart.," 1857.—Lanceraux, "On Syphilis," New Syd. Soc.—Wallace, "On Venereal."—Carmichael, "On Venereal."—Hutchinson, "Syphilitic Diseases of Eye and Teeth."—"Report of Committee on Venereal Diseases," 1868.—Turenne, Academie des Sciences, 1850.—Boeck, "Edin. Med. Journ.," 1858.—"Dublin Journal," 1857.

CHAPTER LXIV.

TUMORS.

IN the pre-pathological period, before the minute anatomy of healthy and diseased tissues was understood, and ere the microscope had rendered intelligible subjects that still rested in darkness, *tumors* had from necessity been studied simply in their clinical aspects, and surgeons, in their attempts to classify them, were guided solely by their most obvious characteristics and their real or fancied resemblance to the natural tissues of the body. As time advanced, more ambitious attempts at classification were made, and the most important work was that of *Abernethy*, who, at the beginning of this century, published his "Attempt to form a Classification of Tumors according to their *Anatomical Structures*." In that able paper he asserted "that the structure of a tumor is sometimes like that of the part near which it grows; and sometimes unlike; that in many cases the nature of the tumor depends on its own action and organization, and merely receives nourishment from the surrounding parts;" and in saying this he gave expression to pathological truths of the greatest importance, and that still remain incontrovertible. The next real advance was due to *Bichat*, who recognized the essential difference between tumors and the parasitic nature of the *cysticercus* and *echinococcus*, although by his followers this parasitic notion was carried out far too fully, for they looked upon cancer as the product of a parasitic growth of *entozoa*. It was left, however, to *Lobstein*, of Strasbourg, to embody *Bichat's* idea, and give it full expression, and he did this by naming tumors as *homeoplastic* that were similar in structure to the natural constituents of the body; and others as *heteroplastic* that were composed of products which differ from the normal tissues. Since that time countless workers have been examining tumors and attempting to classify them—one of the most prominent being *Lebert*, and to him must fairly be attributed the credit of assigning specific elements to specific tumors, each tumor having, in his eye, a definite structure; cancer was to be known by the caudate fusiform cells that even now are looked upon by some as typical of the disease. This notion of specific elements was a very taking one, for it simplified knowledge and induced men to think they had a ready means of deciding upon the nature of any new growth, and had it not been for *Virchow* it is probable the theory would have long held its ground; but in this learned pathologist it found an opponent of consummate power, and as his reasons for disbelieving it are the groundwork of his great book on "*Cellular Pathology and Tumors*," it is well to have them in his own words:

"In Germany the doctrine of specific elements has from the first made few proselytes, and now it is entirely abandoned. From the commencement of my career I have been compelled to combat this error, and I believe that at the present moment we are in a position to demonstrate, in every

direction, that there do not exist in tumors true specific elements which have no analogy with the normal tissues. It is enough for that to remember that the tumor, howsoever parasitic it may appear to be, *is always a part of the body from which it springs*, and that it is not developed in an isolated manner at the expense of some juice, at some one place in the body, by the inherent force of this productive juice. To admit such a mode of development, *de novo*, was possible at a time when it was also believed that entozoa were spontaneously developed in the body at the expense of a liquid or an excretion, by equivocal generation, when no idea had been as yet formed as to how a cysticercus arrived in the abdomen, and there was able to develop itself and grow. There was no other opinion which medical men could then form save that entozoa sprung from animal substances, either from the tissues themselves or from the intestinal mucus (*saburra*). In the present day, when it is known that entozoa always penetrate into the body from without, by a way, often it is true, extraordinary, yet always natural, this analogy can no longer be invoked. This is still more evident since we have come to know that in a free exudation there is no new element produced; that furthermore, the elements of the body itself have a legitimate origin from father and mother (or, to speak more correctly, from father or from mother, for it is a case of parthenogenesis), so that we must completely abandon the idea that a tumor can develop itself in the body as an independent being. *It is a part of the body*; it is not merely contiguous to it, but proceeds from it and is subject to its laws. *The laws of the body govern also the tumor*. This is the reason why it is not an object of natural history that one can regard as foreign from the elements of the body; it is, on the contrary, to be looked upon as embraced within its limits. . . . Hair may make its appearance and grow at a place where we do not expect to meet with hair. But no one will fancy or believe that feathers will grow in the human body. As a matter of fact there are tumors in man which contain hair, and in cutting up geese, tumors are sometimes found containing feathers. But if ever a man engendered a tumor with feathers, or a goose, one with hair, this would be a production, *sui generis*, because the thing produced would deviate from the type inherent to the individual.

"The type which in general governs the development and formation of the organism, governs equally the development and formation of its tumors.

"There does not exist a new, different, independent type.

"What is established by logic in this manner results also from the direct observation of tumors themselves. This is why I deny that there is any heterology in the sense in which it has been maintained since Bichat's time, or such as was supposed even before then, that is to say, that a tumor could develop itself and exist in the body in accordance with some quite new plan, some new law. I go further: each species of tumor, whatever it may be, answers in its important parts to the elements of the body, the type of which is known, and the capital difference amongst divers tumors resides in this, that tissues normal in themselves appear under the form of a tumor, sometimes in regions where this tissue normally exists, sometimes in places where it does not exist in the normal state of things. In the first case I speak of it as *homology*, in the second as *heterology*.

"Wherever a normal tissue appears at a point which already contains some similar tissue, then as a consequence the new tissue is identical with the old, so that the type of the new production answers to the type of the pre-existing tissue; in this case the new tissue, the tumor, is homologous; when, on the contrary, the new type does not correspond with the old one, when it deviates from the pre-existing type, or that which is the original and normal one of the region, then there is heterology. But this latter has

likewise its analogue in the body, only in another part of the body from that in which the tumor is situated.

"We cannot, in my opinion, distinguish tumors according to the tissues, in such a fashion that tumors containing certain tissues are to be regarded as homeoplastic, whilst those containing certain others are to be set down as heteroplastic; quite the contrary, *the same kind of tumor may be, under certain circumstances, homologous, and under other circumstances, heterologous.* The same sort of tumor may at one time appear at a point where it is merely the expression of an excessive development of the tissue normally existing at this point, at another time at a place where this tissue is not in existence, and where its development is abnormal and strictly pathological. Let us take an example, a tumor may be formed of cartilage. The cartilaginous tumor is homologous, not because it is formed of cartilage but only if it springs from cartilage, if in this place there is cartilage already. Thus, a costal cartilage may be the point of origin of an enormous cartilaginous tumor; this is homology. But it is also possible for a cartilaginous tumor to be developed in the testis, which contains no cartilage, where this tissue should not be met with; here the same product constitutes an heterology."

Homology and heterology have, therefore, very different meanings as used by Virchow and other writers. In Virchow's language a tumor is *homologous* when it corresponds in structure with the tissue in which it grows; and *heterologous* when it deviates from that structure. A tumor that is homologous in one position may be heterologous in another. In the French school and others a tumor is *homologous* when built up of elements naturally existing in some tissue of the body, *heterologous* when composed of elements that deviate from the natural structures, these definitions having nothing whatever to do with the position of the tumor. In Virchow's language the terms are relative; in that of other pathologists they have a definite clinical meaning of no slight importance, for homology means innocence in a tumor, heterology malignancy. Virchow, however, admits that his heterologous tumors are suspicious, although *every heterologous tumor is not of a malignant nature.* "There are a great many such tumors borne without any ill consequences, and whose properties are quite similar to those of which the nature is benign. Malignancy follows a certain scale among heterologous tumors, from species to species; and we are able to show how it is manifested more and more strongly—for the most part following two directions. In the first place, heterology is distinguished according to the degree which it attains. The tissues of connective substance have a much nearer relationship existing among themselves than they have with epithelial tissues or with the specific animal tissues. When, therefore, a cartilaginous or bony tumor is developed in connective tissue, or even a mucous tumor in adipose tissue, that is not nearly so heterologous as when an epidermoid tumor is formed in connective tissue, or a tumor of cylindrical epithelium in a lymphatic gland. A cartilaginous tumor which is developed in connective tissue or in the tissue of bone, is indeed heterologous, but it is not so to the same degree as an epithelial tumor or a muscular tumor would be in the same place. But a still more important circumstance is this, that tumors engender certain liquid substances which we speak of under the name of juice. This is the humor or juice of the tumor of which much has been said.

"This parenchymatous juice is sometimes related to the cells, sometimes to the intercellular substance; and accordingly it appears under the form of a fluid either intracellular or intercellular, contained in the cells or interposed among them in a liquid state like serosity. Whenever a tumor contains much juice, it gives evidence of more troublesome properties, and it possesses to a high degree the property of infection. A dry tumor of the

epidermoid kind is by far less dangerous than a moist one; a soft cancer is much more to be dreaded than a hard one.

"The more a tumor is poor in vessels the less will it extend its infecting action beyond the neighboring parts; but the more it is rich in bloodvessels and lymphatics, the more it is traversed by the blood and lymph; the more the parenchymatous juices are in contact with the blood, so much the more is the infection likely to become general.

"I give thus an interpretation of facts, but it is in accord with observation. The degree of contagiousness of tumors increases in proportion as they become more rich in vessels, and that alongside the vessels they contain an abundance of liquid materials. Every soft succulent tumor is suspicious, and that just in proportion as it contains many vessels and cells. The more the juice is intercellular and in contact with the vascular stroma of connective tissue, the more the malignant properties, which are manifested by an ever new excitation to the progressive production of the tumor.

"I ought indeed to speak more at length as to the nature of these juices, but in truth I do not know what to say upon the subject. The results which chemists have arrived at on this subject have no kind of value. Here the field is open to inquiring and progressive, spirits; and I hope that hereafter researches will be undertaken in this direction, and that they may be crowned with success."

But this is not a work on pathology, and I cannot allow myself to enter further into these speculations, and so the reader is referred to Virchow's masterly work on "Cellular Pathology and on Tumors" for a more full elucidation of the subject.

In the following pages I shall regard tumors in their clinical aspect alone, giving their anatomical characters only in that they illustrate the practical. All speculative pathological doctrines will be put aside—as tending to confuse rather than elucidate clinical phenomena—waiting for the day when pathological science shall have so far advanced as to allow of an anatomical classification of tumors being made that will dovetail in fully with that founded on clinical observation. The microscopical anatomy of tumors will be given in the next chapter, furnished by the pen of my friend and colleague, Dr. Moxon.

I purpose, here, to lay down some few pathological points which have an important clinical bearing, and which tend to illustrate the subject of the diagnosis of tumors.

A tumor may be defined to be a new growth, cystic or solid, infiltrating, separate from, or continuous with, normal tissues; it is an addition to, not an increase of, natural parts, for such is a hypertrophy; and it manifests its independent existence by its disposition to grow irrespective of the part in which it is placed. All tumors, with the exception of the hydatid, are made up of one or more of the natural elementary tissues of the body, in a rudimental or morbid state, and in no single example has any extraneous or new element been ever detected. For just as the natural body is built up of cells and fibres in one or other of their different forms, so tumors are made up of like elements, although it may be in unequal proportions. Tumors, like the natural tissues, differ, therefore, anatomically, according to the nature of the elementary structure of which they are composed; and this again appears to be materially determined by the part of the body in which they are developed.

From this, therefore, a second leading principle may be fairly drawn, *that all tumors partake of the nature of the part in which they are developed, and are more or less made up of the elements which naturally enter into its formation.*

Thus a tumor developed in the stroma of a fibrous structure will probably be fibrous; if connected with bone, more or less osseous; and if situated in a gland, it will in all probability partake of the gland structure. But new growths never assume the complicated structure of a fully developed gland, they only in a degree simulate it. Wilks well expresses it that "the great difference between physiological and pathological formations appears to be that nearly all new growths are of the simplest composition, not putting on the form of the complex organs near which they may be placed, but consisting principally of cells and fibres." The cells and nuclei of a part, instead of developing into normal tissues, err in their course, multiplying and possibly growing, and "whilst conforming generally with the part in which they are placed in minute structure and composition, yet they more and more widely deviate from it in shape and size." (Paget.)

The bearing of these pathological principles upon practical matters is by no means unimportant; for to the surgeon, who has once recognized the true position of a tumor, there is a certain amount of probability as to its nature which will at once suggest itself to his mind. If the tumor be situated in the skin or subcutaneous tissue, there is a strong probability that it will be composed of some one or other of the structures of the tissue. It may be the sebaceous tumor, which is rarely found in any other position, or the fatty, for these two materials enter largely into cutaneous structures; or it may be one of the fibrous or fibro-cellular nature, fibre-tissue existing abundantly also in these parts.

Should the tumor be located between the muscles of a part, there is again a probability as to its true nature, which will naturally suggest itself; for, as connective tissue alone exists in these parts, the tumor will probably be composed of some such elements, and these, being formed in excess, will give rise to the growth of a fibro-cellular, myxomatous, fibro-nucleated, or fibro-plastic tumor. Should bone, again be the seat of the disease, some one of the elements of bone will, to a certainty, enter into its formation; the probability of its being an enchondroma, an osseous or a myeloid tumor naturally presents itself to the mind. And lastly, should a tumor be present in a gland, such as the breast, uterus, or prostate, the probability of its being an adenoid or glandular tumor cannot be overlooked; for pathologists now all recognize the fact of the close resemblance of tumors so situated to the natural gland structure.

These remarks, however, apply principally to simple tumors; for it must be borne in mind that cancerous or embryonic cell tumors may exist in any part, cells entering naturally into their formation.

Tumors are either simple or cancerous, innocent or malignant; the simple or innocent approaching in their nature the more highly organized natural structures of the body, even to the perfect glandular; and the malignant or cancerous simulating the more elementary or embryonic. As the normal tissues were formed from a simple cell, and in their higher grades are but a development of that cell or those cells, so the cancerous element consists in a persistence of the simple cell type or that of the undeveloped embryonic nucleus. The group of cases called "recurrent" must be placed in an intermediate position, for while in their earlier stages they tend to build up embryonic tissue, this subsequently becomes lost in cell proliferation.

In proportion, therefore, to the amount of the cell element in a tumor may its cancerous tendency be determined, and the greater the proportion of the fibrous or well-developed structure the greater the probability of its nature being innocent or simple. The more a tumor simulates the natural structure of a tissue or gland, the greater is the probability of its being in-

nocent; the more a tumor simulates the undeveloped cell structure, the greater the certainty of its being cancerous, "malignancy appearing to diminish in proportion as the cells become more fully developed. The active principle of growth lying in the nucleus, it is clear that the more the tumor is composed of nuclei the more malignant is its nature, and the better formed the cell-wall is, so is the growth less malignant. An angular or caudate cell shows a slower growth, and that the tumor has a more healthy tendency. Should the cell develop still further, and become pointed at each end, it would show that the tumor, of which it was the constituent element, was of a still less malignant character. When more of the fibrous element exists, the tumor is consequently still less malignant." (Wilks.)

The nearer a new growth approaches, both in its elements and in the arrangements of its elements or structure, to the complex organs of the body, the greater are the probabilities of its being innocent, new growths under no circumstances coming up to the perfection of a true gland tissue; at the best they are but poor imitations.

Cancer being a purely cell tumor, growing indefinitely where the least resistance is met with, and having no other than cell structure, is, says Wilks, "an objectless cell-growth."

Tumors never change their original nature, nor pass on nor degenerate into others of a different kind. A simple tumor is simple to the end, and a cancerous tumor is cancerous from the beginning. This opinion is a pathological fact, which it would seem unnecessary in these days of advanced pathology to lay stress upon; but oddly enough, an opposite opinion is still repeated in some of the students' text-books, and this being the case, the truth may be again enforced. The above lines are not intended, however, to convey the impression that a patient the subject of a simple tumor may not become the subject of a malignant one, or *vice versâ*, for such may unquestionably be the case; and after the removal of a simple tumor a malignant one may secondarily make its appearance. But no simple tumor by growth or degeneration will become malignant, as no malignant tumor will become innocent. It would appear, however, that in recurring innocent tumors there exists a tendency for such growths to present on each return more the elementary character of the malignant growth, and "that a tumor which, under ordinary circumstances, is loath to contaminate the system may do so under the favoring influence of a long period of time," either as a recurring tumor or as a more malignant one. *Simple tumors separate tissues in their growth, but never infiltrate; cancerous, as a rule, infiltrate, and rarely separate.* No more important practical point can be brought forward to aid the surgeon in his diagnosis of a tumor than the above. A simple or innocent tumor, however long it may be in growing, and however large a size it may attain, will never do more than separate the parts between and beneath which it may be developed. The bones may be absorbed by its pressure, but they will never be involved; and the skin may be so stretched and attenuated by its distension as to ulcerate or burst, but it will never be infiltrated with the elements of the tumor. This fact is well exemplified by a close examination of the margin of a cutaneous opening, the result of over-distension; for it will appear as if cleanly cut, or rather punched, at its edges, and never thickened or diseased. An intracystic growth may project from it as a fungus, and put on many of the appearances of a cancerous tumor, yet the margins of the opening will be free, will not be infiltrated. In the cystic tumors of the breast this clinical fact is well seen. (Fig. 310.)

Simple tumors, by expanding parts, cause the cellular tissue around them to become condensed, and to form a capsule. Most of the innocent

tumors, consequently, are encapsuled more or less completely. With the majority of cancerous tumors, however, a very different condition has to be described, for a cancer has the peculiar property of freely infiltrating all the tissues upon which it presses, at its base, round its margins, and upon its cutaneous aspect. As the tumor approaches the surface, the integument first appears to be drawn down to it, and afterwards is as though glued to its surface (Figs. 303, 405). At a later stage the skin becomes infiltrated with cancerous elements, and to the finger feels firm, fibrous, or tuberculated; and when ulceration has commenced, the edges of the skin are palpably indurated, thickened, and infiltrated with cancerous products (Fig. 309). The contrast between these different conditions of integument in the two classes of tumors is most marked and very important, forming a most valuable means of diagnosis in the extreme stage of simple or malignant tumors.

Simple or innocent tumors affect the patient solely through their local influence; they grow by their own inherent properties, and irrespective of the growth of the parts in which they are placed; they have little disposition to soften down or ulcerate; they have no tendency to multiplication in other tissues, nor to involve the absorbents with which they are connected. Cancerous tumors not only affect the patient through their local influence, but have a marvellous tendency to multiplication in any part of the body, more particularly in the internal parts, and never exist for any period without implicating the lymphatics of the part with which they are connected; they are prone, also, to degenerate and ulcerate.

When simple tumors are multiple, they are always found in the same tissue. When cancerous tumors are multiple, they are mostly found in different tissues. Thus amongst the innocent growths multiple fatty tumors of the skin are not uncommon; multiple fibromata of the uterus are often seen; multiple glandular tumors of the breast are met with involving one or both organs; and multiple fibro-plastic or myxomatous tumors are on record. A remarkable case of this I have to record. It is not seldom that multiple enchondromatous tumors and exostoses are seen; but in all these instances the tumors occupy one tissue.

In the cancerous multiple tumors no such description can be given, for they spread in ever widening circles from the parent tumor; they follow the course of the lymphatics and affect the glands; they at times seem to follow the course of the venous circulation. They recur by continuity of tissue, as from constitutional reproduction, and Mr. Moore has given us some evidence that, in a cancerous tumor within the skull, some detached fragments, which had sunk in the fluid of the arachnoid, had adhered to the spinal cord and grown. They spare no tissue or organ, but invade one and all without order or law in their destructive objectless growth.

All tumors cannot, however, be divided into the *innocent* and the *malignant*, for there is an intermediate kind that in structure approaches the innocent, but in habit the cancerous, and they show this chiefly in their *recurrence* after removal. They have been called consequently *recurrent* tumors; but as the habit of recurrence is not the only point in which they approach the cancerous tumors, it is possibly better to call them *semi-malignant*.

I propose therefore to describe tumors under these three headings:

- Innocent;
- Semi-malignant, or recurrent;
- Malignant.

Innocent or Non-malignant Tumors.—These may be divided into the

"*Cystic*" and the "*Solid*," the cystic under certain conditions becoming solid by the development of intracystic growths.

Cysts are developed in many ways:

1. Some are possibly new growths, or largely developed cells, having an independent life and being capable of secreting their own contents or producing solid growths, autogenous cysts, as Paget calls them.

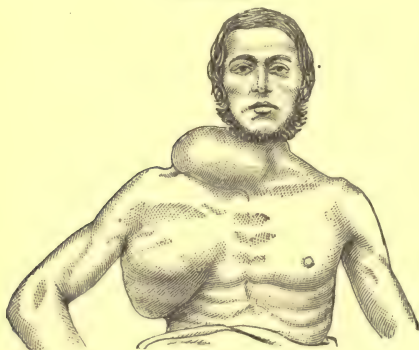
2. Some are formed in an accidental way by the simple effusion of fluid into the spaces of connective or other tissues, the walls of these *false cysts* gradually consolidating, as commonly seen in bursæ and in ordinary tumors.

3. Others are produced mechanically by the dilatation of occluded ducts or natural gland-orifices, the cyst enlarging by the secretion of the ducts or gland contents; of these the mucous cysts of the mouth and vagina, the sebaceous cysts of the skin, and the milk cysts of the breast, are the best examples. Virchow calls these cysts by retention.

But in many cases it is impossible to make out how the cysts are formed.

Serous Cysts are most commonly found connected with one of the vascular glands of the body, as the kidney, ovary, thyroid, or breast, but they are not rare in the connective tissue, and are found even in bones; when seen in the neck they are described as "*hydroceles of the neck*." Some of these are congenital, but the majority occur later in life; they appear as

FIG. 286.



Birkett's case.

single or multilocular cysts, made up of thin membranous walls, lined with pavement-epithelium; like a serous membrane they contain a limpid, watery, or tenacious highly albuminous fluid, more or less stained with blood, which occasionally holds cholesterin in suspension. These cysts are found in the neck, anywhere between the lower jaw and clavicle, beneath which they at times pass (Fig. 286); they are usually deeply seated, occasionally superficial; they give annoyance only from their size; they are painless; when inflamed, they may suppu-

rate. They are to be recognized by their globular cystic form, soft, fluctuating feel, and painless increase.

These cysts are not to be confounded with those of the *thyroid gland*, which are far more common, and which move up and down with the gland on deglutition. These thyroid cysts at times attain a large size, and grow as quietly and painlessly as do the cervical; they have usually, however, thicker walls and are more tense, and are commonly multiple, their contents are more viscid and are more frequently mixed with blood in variable proportions; indeed, some of these thyroid cysts are *blood-cysts*, and when tapped, would go on bleeding, if allowed, even to the death of the patient. I have recorded such a case ("*Guy's Reports*," 1864). It is probable, as Sir J. Paget has suggested, that many of the cervical cysts are thyroid in their origin, springing from some outlying portion of the gland.

Cysts are also found over the thyroid cartilage, but these mostly contain grumous blood; they rarely grow larger than half a walnut. I have a case under observation at the present time in which a cyst completely covers

the thyroid cartilage, and is lost on either side in the deep tissues of the neck; it exists as a soft fluctuating swelling of some years' painless formation in an adult man.

Cysts are likewise found in connection with the hyoid bone; these are possibly bursal.

TREATMENT.—Cervical cysts had better be left alone, unless from their size they demand surgical treatment, for there is always danger in dealing with any deeply seated cyst in this region from the liability of subsequent diffused inflammation of the cellular tissue of the neck. I lost a patient from this cause, some years ago, after simply tapping such a cyst.

When surgical treatment is called for, *palliative* means had better be primarily adopted, this treatment consisting in simply drawing off the contents of the cyst by means of a trocar and canula, or the "aspirator" (Fig. 160), and should the fluid re-collect rapidly the operation may be repeated. In performing this operation the surgeon should guard against puncturing any of the superficial veins or deep vessels—recalling to mind their position before puncturing.

Should gentler measures fail even after several repetitions of the operation of tapping, the best practice is to introduce into the cavity of the cyst a drainage-tube, made of perforated india-rubber tubing. When the tapping has induced some suppurative action the opening may be enlarged and the tube inserted, but in large cysts it is well to pass the tube completely through the cyst. This may readily be done by means of a long trocar and canula, such as that employed for puncturing the bladder per rectum, the pilot trocar being introduced into the cyst, after it has been opened at a dependent point, and then made to traverse the cyst, possibly beneath the sterno-mastoid muscle to the opposite side, and then the pilot is removed and the canula left. Through this the tubing should be inserted, the canula being subsequently taken away, and the two ends of the tubing should then be fastened together to prevent their escape.

I have treated five cases of deep cervical cysts in this way, and with success. I have not had one in which any bad result followed. The great point to attend to is the free escape of all pus and cyst contents; if air gets in, let the opening be free enough for it to pass out. Should fetor appear, the cyst should be washed out daily with Condyl's fluid or some other disinfectant. As the cyst contracts the tube may be removed, but as long as any cavity remains, it should be left. The passage of a seton through the cyst is another method which may be adopted; it is probably more adapted for small than for large cysts. Injecting the cyst with iodine is a third method which has proved successful. It is, however, as dangerous as any other, and not more successful. Extirpation of any large cervical cyst is a plan of treatment which should not be entertained. It is fraught with danger and difficulties.

Thyroid Cysts may be tapped like the cervical over and over again, this simple operation being often successful for a long period, and at times permanently so. When more is wanted, the injection of iodine should be selected, one or two drachms of the compound tincture being employed, according to the size of the cyst. When a *blood-cyst* has been tapped, the flow of blood will usually cease on the removal of the canula; the tapping may cure it. In the cysts over the *thyroid cartilage* a puncture may be made, but when the fluid re-collects or is of a grumous kind an incision into the cyst in the median line appears the best practice. I have done this on several occasions with success; the scar is very slight. The treatment of cysts and tumors of the thyroid will, however, receive attention in another page, chapter lxvii.

The reader should remember that *nævi*, when they degenerate, commonly show cysts in their structure (Fig. 66, p. 196); these are, however, usually clustered together in a cutaneous or subcutaneous group. When they appear in the neck they might be mistaken for one or other of the cysts already alluded to. The error will be prevented by recalling the fact that they occur, and by the history of the case, &c.

Mucous Cysts are found wherever mucous glands exist; they are caused by some obstruction to the escape of the gland contents, and contain highly tenacious mucus like liquid albumen. They appear on the mucous membrane of the lips as *labial cysts*, small, tense, globular, painless swellings. They are found within the cheeks, upon the gum, particularly of the upper jaw and antrum, and very commonly beneath the tongue.

Sublingual Mucous Cysts.—Such cysts have been usually described as cases of "*ranula*." They are now known to be due to obstruction to the ducts of Rivini's mucous glands, and have nothing whatever to do with the salivary organs (chapter xxviii, p. 241). Such a cyst may develop about the larynx, and cause obstruction, and they have been found in the œsophagus. They are common also in the labia of women and in the vagina; as *labial* and *vaginal mucous cysts* they appear as tense, globular tumors beneath the mucous membrane of the parts. I have seen them as large as an orange. These cysts generally contain thick, ropy, mucoid fluid of a colorless or slightly yellow tint. Occasionally this fluid is mixed with blood in different proportions. I have seen them contain black thick fluid, milky or coffee-ground fluid. Sometimes these cysts inflame and suppurate, forming abscesses.

TREATMENT.—Small labial cysts may often be turned out as a whole on dividing the mucous membrane over them, but the sublingual and larger vaginal cysts cannot be thus treated. A free opening into the cyst and the introduction of a good plug of lint soaked in iodine, to excite suppuration, may at times suffice, but it is uncertain. In the so-called *ranula* it may be tried before other practice is adopted (chapter xxviii). In the sublingual, labial, and vaginal cysts, I have for some years been in the habit of seizing the upper surface of the cyst with a pair of forceps or tenaculum, and cutting it off with scissors, in this way freely exposing the deeper wall. In the sublingual this practice is, as a rule, successful without further treatment, but in the labial and vaginal cysts I generally apply some caustic as the nitrate of silver freely to the exposed surface and thus destroy it, after which the wound will granulate healthily.

When these cysts can be excised the operation may be performed. The cyst must be destroyed or the secretion will go on.

The mucous cysts of the antrum and upper jaw have been described in chapter xxix.

Cutaneous Sebaceous Cysts, as they come under the notice of the surgeon, appear as "*congenital*" and "*acquired*" tumors. They are analogous to the mucous cysts, in both instances the glands of the tissue being at fault. Some are doubtless caused, as first described by Sir A. Cooper, by the obstruction to the orifice of the sebaceous glands of the skin, for this occluded orifice may often be seen as a small depressed black umbilicated spot upon the tumor; through this orifice the contents of the cyst may often be squeezed, or into it a probe may be passed. In a large proportion of cases on making an attempt to raise the skin from the tumor, a dimple or evident connection between the two will become apparent, this fact revealing its nature. But in other cases no such obstructed duct or even cutaneous depression will be observed; and although the tumor may be developed within the integument, it is probably a new formation, an adenoid or glandular skin tumor.

The **congenital** sebaceous tumors differ from those usually met with in the adult, or the acquired form, in being more deeply placed: they are rarely cutaneous, mostly lying beneath the fascia of the part, occasionally beneath the muscles. They are more common about the orbit and brow than any other part; the external angle of the eye is their favorite seat. They appear as small, hard, semiglobular masses deeply placed; indeed, they are often upon the bone, and cases are on record in which, by their presence, they have produced perforation by absorption of the bone; in the ear this result is not rare. These cysts are thin-walled, and often contain liquid secretion; sometimes it is of a pearly whiteness, and not rarely mixed with hair. I turned a complete ball of hair out of one not long since, but usually the hairs are fine like eyelashes mixed with the sebaceous matter. The contents of these congenital cysts are rarely offensive.

The **acquired** sebaceous cyst may be found on any part of the body which is covered with skin. They are more common on the head and face than anywhere else, two-thirds of all cases occurring in these regions: when on the scalp they are known as "*wens*." They are always surrounded by a cyst-wall, and when enucleated from their bed this cyst-wall is always to be seen; it is composed of fibrous tissue more or less dense. In "*wens*," however, there is a marked peculiarity on this point which demands a notice. "The chief peculiarity consists in a thick dense horny capsule, which is closely in contact with the fibrous envelope of the original gland. This horny capsule was formerly regarded as the cyst-wall altered by pressure, until Mr. Prescott Hewitt demonstrated its true relations and anatomical structure in his lecture at the College of Surgeons. It is now clearly proved that when one of these sebaceous tumors is squeezed out after the division of the skin, that the fibrous cyst remains behind. This cyst can be afterwards excised and its structure is identical with that of all the others. But the construction of the horny capsule requires explanation. If carefully examined, it is found to consist of epithelium, layer upon layer, mixed up with sebaceous matter. Sometimes a solid mass of epithelium is formed; in other instances a cavity exists in the centre, filled with soft sebaceous secretion. This capsule then seems to be a production of the epithelium of the sebaceous gland, which being subjected to the pressure of the unyielding textures in which the tumor is developed, becomes converted by slow degrees into a tissue closely resembling horn or fibro-cartilage" (Birkett, "Guy's Rep.," 1859).

The sebaceous tumors are more common in women than in men, and are certainly hereditary. Paget says "they are certainly more commonly hereditary than are any forms of cancer." In Fig. 13, p. 90, this affection is illustrated.

Fungating and Follicular Tumors.—In neglected examples of sebaceous cyst the contents of the tumor may soften down, and causing suppuration may escape externally by ulceration. From the inner surface of the evacuated cysts a new growth may spring up, which is of a peculiar nature, and forming an irregular, fungating, bleeding surface at times puts on an appearance which has been mistaken for cancer. On examining the edges of the wound, however, this mistake can hardly be long entertained, for it will be at once observed that the edges of the wound are healthy, and not infiltrated with new matter, as would be the case in a cancer (Fig. 287). This fungating growth is really composed of exuberant granulations from the cyst itself. Abernethy recognized this when he said, "I have also seen after the bursting of an encysted tumor the surrounding parts indurate and throw out a fungus, forming a disease appearing like a cancer and which could not be cured." And "it is no uncommon circumstance to meet with

wens that have burst spontaneously and have thrown out a fungus, which, like a fungus body, prevents the surrounding integument from healing." The best account of the affection is by Mr. Cock ("Guy's Rep.," 1852).

FIG. 287.



TREATMENT.—The only correct treatment of these cysts, whether whole, broken, or fungating, is their removal. In removing "wens" it is not necessary to be too careful in dissecting the cyst out entire, as was formerly the fashion, the most effective method being to slit open the tumor with a bistoury and turn it out with the forcep or handle of the knife; the cyst-wall itself is left closely connected with the skin, but no harm results.

In the removal of sebaceous cysts from other parts of the body the capsule of the cyst should be taken away; in the fungating tumor the whole should be excised; in the congenital tumor a like practice should be followed when possible, but nothing is more unsatisfactory than operating in such cases, for the cyst is always deep, its capsule thin and adherent, and any attempt to dissect it out, as a whole, is too often foiled by the bursting or puncturing of the capsule and the escape of its contents. When this happens the surgeon must take away as much of the capsule as he can and close the wound; a good result, as a rule, follows, but at times a recurrence of the growth will take place. It is always well to try and dissect these cysts out whole.

The fear of erysipelas after these operations is really almost groundless: it may occur, but out of more than one hundred cases consecutively observed, I have not seen one example; pyæmia may follow this as any other minor operation, but not more frequently.

When patients are cachectic, such an operation of expediency as that for the removal of a "wen" had better be postponed, for under low conditions of health blood poisoning is likely to follow; should its removal be urged, this may be done by the injection into the cyst of some caustic, such as a few drops of the deliquescent chloride of zinc, or the external application of nitric acid or potassa fusa to produce a slough through the skin, when the contents of the cyst may be turned or drawn out.

The dermoid cysts of the ovary are only of pathological interest, as are the dentigerous cysts of these parts. The dentigerous cyst of the jaw has been alluded to, in chapter xxix.

Fatty Tumors, otherwise called lipomata, or steatomata, are very common; they are found wherever fat exists naturally in the body, and as this material is more especially deposited in the integument, it is in and beneath this that fatty tumors are most frequently met with. They occur at all periods of life, from infancy to old age, and are even congenital; they attack the male sex as well as the female, but they are three times as common in the latter; they are generally single, but occasionally multiple. I have seen a case in which the whole integument was studded with them; under these circumstances the tumors are usually small. It is impossible to assign any good cause for their development; hereditary and accidental causes have a doubtful influence. They are troublesome only from their position and the deformity they occasion (Fig. 288); at times they are the seat of pain, but such a symptom must be looked upon as an accident due to their position.

These tumors are, as a rule, "encapsuled;" in rare cases they are "continuous" or "diffused;" this latter variety differs only from the former in that it is made up of smaller lobules of fat, and is denser, while it is more common about the nape of the neck and face than the encapsuled variety; the large double chin is an example of the continuous lipoma, and congenital lipomata are generally of this nature.

The encysted lipomata are most common on the shoulder, thigh, and trunk; some are deepseated, as between the muscles or within the abdomen, scrotum, &c.

Fatty tumors at times shift their position, that is, they drop downwards; several such cases have passed under my notice, the tumors having travelled some distance. Such an occurrence is peculiar to this form of tumor, and, when present, fixes its nature.

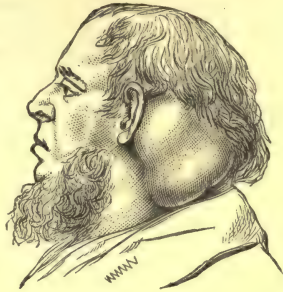
The *diagnosis* is not usually a difficult task; if the tumor be deep a doubt may be felt, but, practically, the question is not of great moment, for it only refers to the nature of a simple growth, and not to its treatment. If subcutaneous, these tumors are lobulated and encysted, that is, are defined by a distinct boundary, their cyst-wall being formed by the condensed fibro-cellular tissue in which they are developed. To the hand of the examiner the tumor will feel more or less firm, and to be made up of lobes; to the eye the skin will, on raising the tumor from its base and distending the skin, appear dimpled, and in parts drawn inwards towards the new growth, this dimpled aspect being very characteristic.

TREATMENT.—When no necessity exists for their removal they should be left alone. When large and unsightly, cumbersome or growing, they should be removed by excision. A single incision through the centre of the growth is the best and most expedient method, the tumor being pressed out from below or dragged out, the finger readily turning the cyst out of its bed. In the pendulous growth the whole should be cut off, leaving enough skin to cover the wound. After the operation the edges of the wound should be brought together by strapping and steady pressure applied; rapid union usually follows. Fatty tumors, when removed, very rarely return. Curling has, however, recorded a case in which a recurrence took place, but so much connective tissue was present in that example as almost to remove it from the class of lipoma ("Path. Trans.," vol. xviii, 1867). I have also recently removed from the buttock of a lady a lipoma the size of a fist, of two years' growth, from whom I had removed, twelve years previously, a like tumor.

The "continuous" fatty tumor should never be removed unless urged by a very strong necessity. The operation is comparatively a formidable one, so much dissection being required. In children, however, they may be dealt with.

Fibro-cellular and Myxomatous Tumors.—The term "*fibro-cellular*" was originally given by Paget in his classical lectures on tumors to a group of new growths or outgrowths that were made up of tissue more or less resembling the normal fibro-cellular or connective tissue of the body, and the term "*myxoma*" has been given by Virchow to the softer, looser, and more succulent or mucous variety of this group. Billroth calls this "*myxosarcoma*;" Müller, *collonema* or *colloid sarcoma*. In the typical *fibro-cellular* the tumor is firm, with a homogeneous surface on section, bands of delicate

FIG. 288.



filamentous white fibre tissue intersecting its substance. Microscopically these bands are composed of fasciculi of delicate fibres of connective tissue which freely interlace; while elongated corpuscles and nuclei, varying in abundance in different specimens, are found within the fibrous meshes. The tumor is more or less œdematous, serous fluid on section draining away. In the typical *myxoma* the tumor is less firm but more elastic than the former; its nature is far less homogeneous, and presents less well-marked interlacing fasciculi of connective tissue, and from the meshes of this tissue will flow a variable stream of clear, translucent, viscid mucus. Under the microscope the fibres of the connective tissue will be seen, but in smaller bundles and more drawn out, and abundance of cells, rounded, elongated, branching, and even anastomosing; these, with nuclei, will be found to fill the cavities formed by the confused network of delicate fibres of which the tumor is composed. The structure of the tumor, says Paget, closely resembles the embryonic connective tissue, or the Whartonian jelly of the umbilical cord. Between these two extremes are found in practice many intermediate varieties, the cell elements or the fibrous predominating in different proportions with the viscid mucous secretion. In the *myxomata*, fat often forms an important element in its structure; glandular elements may also be found, this point being determined by the position of the growth and the propinquity of a gland. Bone or cartilaginous elements are at times mixed with the others. The fibro-cellular growths are mostly outgrowths, and the different forms of softer polypi and cutaneous pendulous tumors are of this nature. The polypi of the nose are the best specimens of the looser kind of fibro-cellular growths, for in consistence they vary from a watery pellucid pendulous outgrowth to a firm, more compact, and fibrous tissue. They are, however, always covered with mucous membrane with its ciliated epithelium. The softer tumors of the antrum are also of the same nature, as are the mucous polypi of the uterus, bladder, and rectum. In the rectum the fibro-cellular tissue is intimately mixed with the glandular elements of the part. Amongst the fibro-cellular outgrowths of the integument those of the male and female genital organs are the most common. The tropical elephantiasis scroti is of this nature. The pedunculated outgrowths of the skin are also of the same kind.

Fibro-cellular growths, as deep-seated tumors, are very rare. They do occur, however, in the connective tissue of the body, the intermuscular spaces of the thigh and arm being the most common seat. They are *always surrounded by a capsule*, and when not confined by unyielding parts, more or less ovoid; at times they are lobed. They possess a smooth outline and an elastic feel; some of the softer kinds, indeed, give the idea of fluid. They are tumors of adult life, being rarely met with in children. They increase in size with variable rapidity, the amount of fluid they contain materially affecting this point. The pendulous fibro-cellular outgrowths, mucous or cutaneous, at times swell out and at others contract, those of the skin appearing shrivelled and loosely encapsuled.

Those of the genital organs may attain a very large size, some of forty pounds being on record. At times these tumors inflame, slough, or ulcerate, all these actions being of an indolent character, and having nothing typical.

Myxomas are mostly soft, succulent tumors, made up of loose connective tissue, and more or less of their own special tenacious gelatinous secretion. They are not rare about the angle of the jaw, nose, breast, abdomen, &c. They are met with also in the extremities and in the eye. They are seen also in the delicate connective tissue of the nervous system, particularly of the brain and also of the nerves. When attacking the brain and nerves

such growths are commonly found in the young; Virchow has named them *gliomata* (Fig. 295), the cells being of a small round or pointed form, imbedded in granules and held together by delicate fibres. In some cases the fibre element approaches the firmer kind of fibro-cellular tumors.

TREATMENT.—Excision is the only practice that can be followed; and although this operation need not be performed when the tumor is small and not progressing, and in aged people, it is a wise one to adopt as a general rule. Good success also usually attends the practice; in the firmer fibro-cellular varieties and myxomas, a return of the tumor is not to be looked for, but in the softer myxomas where cell element predominates the risks of a return are great, the prognosis depending entirely upon the proportion of cell element existing and the succulence of the growth.

Fibrous Tumors—Sarcoma.—This term is applicable to the denser form of tumors or outgrowths made up of fibre tissue or closely-packed connective tissue elements (Fig. 294). When mixed with the non-striped muscular fibre, the growth is known as "*fibro-muscular*," or as a "*myoma*" (Virchow's term). When associated with cysts, it is called "*fibro-cystic*," and when with calcareous matter "*fibro-calcareous*." These varieties are found chiefly in the uterus. Fibrous *outgrowths* or *polypi* are commonly met with in the uterus, pharynx, and occasionally in the rectum. They have been found in the intestine and other parts. Fibrous tumors are found likewise in the uterus and prostate, but not rarely in connection with the bones, periosteum, nerves, and skin. In those about the bones the elements of bone or cartilage are usually found. **The fibrous outgrowths have no capsule**, but are continuous with the tissue from which they spring, and are made up of fibre tissue more or less closely packed and arranged in bundles or in concentric circles; they are but feebly vascular. Those of the uterus are the most typical (Fig. 289).

Fibrous tumors are always encapsuled, and have a tendency to assume an ovoid or globular form when not confined, but when compressed or bound down by surrounding parts, an irregular lobular shape. In structure they are very similar to the outgrowths.

The feel of a fibrous growth is firm, and at times most unyielding. They are slow in their increase, and give pain only from their position. When bound down by a dense fascia or near a nerve they cause much distress. They interfere with life or comfort simply mechanically. They are usually single except in the uterus and in connection with the nerves. As they come under the notice of the surgeon, those connected with the periosteum or bones are the most common, *periosteal sarcoma*, and of all bones the jaws are the most frequent seats. They are chiefly periosteal and appear as outgrowths (*vide* chapter on Tumors of Bone). The pharynx is another common seat (chapter xx, p. 127). The fibrous tumors of the ear have

FIG. 289.

Drawing 387⁹², Guy's Hosp. Mus.

been already alluded to. Those of the nerves, "neuromata," and the painful subcutaneous tumors have also been described (chapter xix).

The Subcutaneous Fibrous Tumor is a hard movable tumor beneath the skin. It is usually small, but when of a less dense kind and more nearly approaching the fibro-cellular tumor, it may attain a large size. Under these circumstances the skin will become part of the tumor, it will then often ulcerate and allow the growth to protrude through the opening and ulcerate or even slough, these tumors thus bleeding freely. At times these fibrous tumors seem to grow from the deep fascia.

Excision is the only treatment that can be followed which offers any prospect of success, and when these fibrous tumors are removed a recurrence is rarely met with. The fibro-muscular, fibro-cystic and fibro-calcareous tumors are mostly uterine.

Enchondromata, or Cartilaginous Tumors, are most commonly met with in connection with bone; they are next in frequency found in the parotid or submaxillary regions, and are seen in the testicle, intermuscular septa, and other parts.

They appear, as a rule, in young subjects, in people under middle age, and my own notes tell me that they are far more common in the female than the male; they are usually slow in growth, the majority having existed years before the patient seeks advice, exceptional instances only of rapid growth being on record. These tumors, when not outgrowths, are always encysted, and have a smooth, tense, and elastic feel; in some examples they are uniform and even, in others they are bossy and nodulated; they rarely cause pain, and produce anxiety simply from their position and size. Those in the parotid or submaxillary region appear to grow superficially, and to be movable; but they often dip down deeply into the tissues, and require considerable care in their removal; they are, as often as not, very adherent to the parts around. These simple parotid tumors rarely involve the facial nerve or cause paralysis, as the cancerous tumors do. When the cartilaginous tumors grow *within* bones they expand the osseous wall as a shell.

These cartilaginous tumors are usually innocent, and consequently only separate the parts between which they are developed; they never involve the integument by infiltration, but only stretch it; in exceptional instances they excite inflammation and ulceration in the skin, with subsequent perforation; they do not affect the system through the glands, although it must be added that rare examples are on record in which cartilaginous tumors have returned and have affected the lymphatic system like a cancer. Paget has recorded such an instance in the "Med.-Chir. Trans.," 1855, and De Morgan in the "Path. Trans.," vol. xx.

The section of a cartilaginous tumor is fairly characteristic (Fig. 290); it

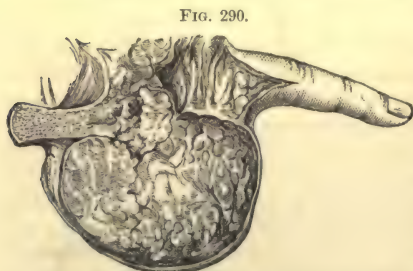


FIG. 290.

Section of an enchondromatous tumor expanding metacarpal bone.

cuts crisply and presents a smooth surface; it may appear of one mass, or made up of many lobules. In some cases the consistence of the tumor is close, and is made up of translucent or bluish masses of fetal cartilage; this is the best seen in the periosteal forms; in others it is loose and granular, as in those expanding the bones. In many fibre tissue or glandular tissues is intimately mixed with it, the parotid tumor affording the

best type of this kind. In the cartilaginous tumors of bone, bone elements are always found; and in those of periosteum, fibrous elements; where glands are involved glandular structure. When cartilaginous tumors soften down cysts are found; these cysts usually containing a dirty brown serous fluid, but they may be filled simply with broken-down tissue and pus, or a more tenacious synovial kind of fluid.

Microscopically, cartilaginous tumors present diverse forms, simple foetal cartilage cells imbedded in a hyaline matrix, in a granular matrix, or a fibrous or glandular stroma being present in different cases, or even in different parts of the same growth. The most typical form is that in which the cartilage cells are grouped together in masses, surrounded by fibre tissue, and from this type great deviations occur, the cells being, more or less, scattered between the fibres. In some instances the nuclei of the cells are free and numerous, in others they are filled with granules or oil-globules, apparently degenerating. Occasionally, the cartilage cells are developing, and take on the mature form of bone cells. (Fig. 293.)

TREATMENT.—The removal of the cartilaginous growth is the only efficient treatment, but the practice must be determined by the position of the growth, and all the other points with which the tumor is clinically surrounded. When removed a return rarely takes place; cases are, however, on record, and the Guy's Museum contains a few, in which a return ensued after excision even a second or third time, but such cases are exceptional.

The cartilaginous tumors of bone will be considered amongst the diseases of bone.

Osseous Tumors naturally come to be considered after the cartilaginous, for the two elements are usually combined; and as in the enchondromas traces of bone may be found, so in the osseous traces of cartilage may exist.

These tumors are found in two forms, the *cancellous bony tumor* and the *compact bony tumor*, better known under the name of ivory exostosis. The latter growth is peculiar to the bones of the skull.

The cancellous is almost always developed through cartilage, and made up of tissue precisely similar to the cancellous tissue of bone; in some cases it is covered with a thin casing of compact bone, like the cartilaginous tumor growing within a bone, but in most it is covered with a layer of cartilage, by the ossification of which it grows. A drawing illustrating these points will be found in the chapter dealing with exostosis. This subject in its clinical aspect will be again considered in the chapter on tumors of bone.

Myeloid Tumors are, as primary growths, always found associated with bone, either growing from the bone, as in "epulis," or more commonly in the bone, and when in this position usually in the articular end. The term was given to the class by Paget on account of the likeness between its cells and those of foetal marrow. Lebert calls them "fibro-plastic," Virchow "giant-celled sarcoma."

When these tumors are periosteal they have the clinical features of a fibrous growth; when within the bone, they appear as chronic expansions of the articular extremity or shaft. They are usually slow in their progress, and are often painless. When large and so expanded as to have burst through their osseous case, they appear cystic and semi-fluctuating—even pulsatile. They are not connected with any cachexia or glandular enlargement as a cancer. The disease is one of youth and young adult life, and the growth is usually single. A myeloid tumor presents in section a peculiar appearance. It may be solid or cystic in variable degrees; osseous matter, fibrous matter, or fluid may exist in different proportions; but in every specimen the cut surface will present blotches of a pomegranate crim-

son or of a darker blood color, and these tints will mingle more or less regularly with the other tissues. In some instances the cystic element predominates, and it is a fair belief to entertain that many of the cases of cystic expansion of the articular extremity of a bone are due to myeloid disease.

Under the microscope the characteristic polynucleated cells are seen; large, round, or irregular cells, containing many, even ten or more, oval, well-defined nucleated nuclei floating in a clear or granular substance. With these cells Lebert's caudate or spindle-shaped cells are also found. (*Vide* Fig. 294.) These characteristic cells are found in masses or differently distributed throughout the tumor between the bundles of fibre tissue, and are diagnostic.

Myeloid tumors when removed rarely return; such instances, however, have occurred. I have seen one, and Paget has recorded others.

Glandular or Adenoid Tumors are new growths simulating more or less perfectly the gland structure in the neighborhood of which they grow; they are not hypertrophies of the glands, but distinct tumors. In the breast it is the usual innocent tumor of the organ, *adenocoele*, but it is found in the prostate, uterus, lips, tonsil, thyroid, and integument. They are not rare as lymphatic glandular tumors. Fig. 296 represents admirably the microscopical features of the adenomas as a class. They are growths of young life, and are found during the active period of a gland's existence. They are always encapsuled, and can usually be readily turned out of their bed on dividing the capsule; they usually assume a rounded or ovoid shape, and are distinctly movable beneath the integument, which is not involved. "On section," says Paget, "they commonly appear lobed, or intersected with partitions of connective tissue, and are pale, grayish or yellowish white; in some specimens looking translucent and glistening, in others opaque; in nearly all acinous or glandular. To the touch, some, especially the white and more opaque, are firm, tenacious, and elastic; others, especially the yellow and more glistening, are softish, brittle, slippery, and succulent, with fluid like serum or synovia. Not rarely cysts are imbedded in the solid growth, and filled with serous or other fluids like those which are found in the barren cysts of the mammary gland itself. In the labial and parotid glandular tumor portions of cartilage or bone may be mixed with the glandular structure; and sometimes—chiefly in the mamma—the glandular tumors appear as if formed wholly or in part of clusters of small sessile or pendulous growths, filling cysts or partitioned spaces; thus indicating their relation to the proliferous cysts, and suggesting that they originated in such cysts. The textures around the tumor are usually quite healthy, altered only by displacement" (Fig. 308). These glandular tumors are usually single, but at times multiple. Thus in the breast they may be many, and these may be so loosely encapsuled as to move about as in a bag; in the lips they are commonly numerous; and lymphatic glandular tumors are almost always multiple. They grow with very variable rapidity, at times more slowly, at others with great speed. They require removal only from mechanical causes.

To remove them it is only necessary to divide the capsule with the soft parts covering them in and to enucleate them. This need not, however, be done under all circumstances, for these glandular tumors not only cease to grow but at times disappear; thus operative interference should only be entertained when the growths are large or growing. Medicine does not appear to have any influence upon their increase.

The glandular tumors of special regions will receive notice in the different chapters devoted to their consideration.

Vascular and Erectile Tumors are considered in chapter xxv.

Papillary Growths or Tumors require a brief notice; they are found in the outside skin, or inside skin—the mucous membrane—and instances are on record where they were found on serous membranes. On the skin they occur as warts, cauliflower or sessile, and as condylomata; some of the horny skin growths are of this nature. They occur in the mucous membranes as villous growths, and I have seen them on the hard and soft palate, tongue, rectum, and bladder; the two latter regions are indeed common seats of the affection. They seem to be a mere delicate outgrowth of subcutaneous or submucous tissue, with their natural epithelial covering, at times involving the gland structure of the part; they are usually innocent, but at times cancerous elements infiltrate the parts.

Recurrent or Semi-Malignant Growths.—It will have been observed that in nearly every group of tumors that has been described, a recurrence of the tumors after removal has been alluded to as a possible, although a rare, termination; and, in this recurrence the new growths approach in character to the malignant. In some cases, doubtless, the second tumor has been simply the external manifestation of a small one that existed when the original tumor was removed, or the increased growth of a portion of diseased tissue that was left—for small tumors may often not be seen when large ones are being excised—the incision of the surgeon leaving them unexposed. On two occasions, when removing a mammary glandular tumor, I have seen a minute growth of a similar structure exposed by the incision made through a portion of the healthy mammary gland to reach the principal growth. In both these cases had the small tumor been left a recurrence would have been recorded. In cases of recurrent fatty tumor it is highly probable a small portion of the tissue was left, and in that of fibro-cellular tissues the same arguments may be employed. Not long ago, when I was enucleating a fibro-cellular tumor of several years' growth from beneath the fascia covering the scapula, I discovered two smaller ones which might have been overlooked and that would certainly have grown. Nevertheless, it is a clinical fact that tumors, which are usually looked upon as innocent, occasionally recur; and the more the cell elements predominate in a new growth, the greater its succulence, and the looser its structure, so much the more does it appear prone to return. Each tumor as it recurs also generally becomes less solid, more succulent, and more rapid in its growth; with each recurrence the cell elements increase in proportion, and in all ways; "later formed tumors assume more of the character of malignancy than the earlier." Paget named all these recurrent tumors "recurrent fibroid," and these are usually composed of elongated, oat-shaped, caudate, nucleated cells, like the so-called "fibro-plastic" cells, which are found in granulation and embryonic connective tissue. Virchow calls this tumor "sarcoma." (*Vide Fig. 294.*)

It must be observed that these tumors, as a rule, attack the young and healthy; they grow from a fascia or aponeurosis, are of slow growth, particularly at first, and destroy life only after many years, and from local causes. They return either in the spot from which they originally sprang, or from its immediate neighborhood. They affect the part simply mechanically, by separating and surrounding tissues, but never by infiltrating them; the skin is stretched over the tumor, but never involved in it; and if destroyed it is by ulceration from over-distension, while the absorbent glands are never secondarily involved, even in extreme conditions. Such tumors are to the hand more or less fibrous and lobulated, their fibrous feel being much influenced by their rapidity of growth. When cut into they present a more or less compact surface, a clear serous fluid infiltrating

its meshes; and even the finest microscopical section will be found tough and tenacious, and incapable of being pressed into a diffuent mass. Under the microscope they present an excess of nucleated cells and nucleated fibres, this, again, showing their tendency towards the characters of the malignant growth.

The treatment of recurrent tumors need not differ from that of the innocent, for as long as the disease is a local one, there is a reasonable hope that it will at last fail to recur after removal. "Paget has known cases in which recurrence ceased for at least seven years after a fourth and a sixth operation; and after every operation the patient may expect to enjoy a period of comfort. Dr. Esmarch, of Kiel, told Paget that he had seen cases of recurrent fibroid tumor cured, and not again returning, in patients who took large doses of iodide of potassium for several weeks. Generally, however, the prognosis of recurrent tumors must be unfavorable unless Dr. Esmarch's plan prove often curative. The ordinary course is that the tumors constantly recurring grow more rapidly; leave shorter intervals of health, protrude sooner, bleed and discharge ichor more freely, and affect deeper and deeper structures, till excision becomes too dangerous, and the patient dies exhausted" ("Holmes," vol. i, ed. 2).

Cancerous Tumors.—What is a cancerous tumor? of what is it composed? and how is it to be recognized? are three questions which the student is constantly asking, and there are few which are more difficult to answer with accuracy or precision.

Pathologically, a cancerous tumor is *not* composed of any definite or characteristic elements, such as at once stamp it as being a cancer; it does not contain any distinct cancer cells which mark its nature, for the cells, nuclei, and fibres, which enter into the formation of a cancer may all be traced in other and in innocent morbid growths. "But neither in tumors of innocent character, nor in natural tissue, do these elements combine in such variety as is common in a single cancer" (Moore). It does not appear, however, to be incorrect to assert that the more the cell elements predominate in a growth, and the more they approach an epithelial type, the greater is the probability of its being malignant, and therefore cancerous; for the soft cancers, which are undoubtedly the most virulent, are made up almost entirely of cells and nuclei—only enough fibre tissue existing to bind and hold these cells together.

It has been already shown how the so-called innocent tumor approaches the malignant in some of its features; and it will have been observed that these which form the intermediate links between the innocent and malignant, structurally approach the latter, in having more of the cell elements in their composition. The fibro-nucleated and recurrent tumors exist as proofs of this.

But these points touch only the anatomy of those growths, and not their symptoms; they do not assist the surgeon to make out before its removal whether the tumor before him be a cancer or not. And here it must be stated that in making a diagnosis the history and progress of the disease is at least as important as the physical characters of the tumor.

What, then, are the external and general symptoms by which this point can be determined?

If a tumor is found in a part, *infiltrating the tissues* with which it is in contact, there can be little if any doubt as to its being a cancer, for no innocent growth infiltrates tissues—it simply separates them. This question of infiltration of a part, or merely separation of it, is most important, and is, doubtless, one of the most valuable means we possess for the purpose of a correct diagnosis (Fig. 306).

A cancerous tumor does not, however, always infiltrate a part, although an infiltrating tumor is almost always a cancerous one; for it may appear as a distinct and isolated growth, being then, in surgical language, described as tuberos (Fig. 307). What, then, are the symptoms by which a tuberos cancer may be known? And first of all, has the tumor itself any peculiarities by which its nature may be recognized? Unfortunately, a negative answer must be given to this question, for although it may not be an unfair thing to suspect the presence of a cancer when the tumor does not present any of the special appearances or symptoms which commonly characterize the innocent growths, it can only be a suspicion, as many innocent tumors are often deficient in the special symptoms, which, when present, readily attest their true nature.

A subcutaneous tumor, unconnected with the integument, with an irregular bossy outline, and of a firm, fibrous feel, will, in all probability, be a simple tumor, for these are not the characters of a malignant one; but a tumor with a smooth uniform external surface may be either a simple or malignant growth. We must, therefore, look to other than local, although concomitant symptoms, to aid us in a diagnosis. I have already alluded to the tendency which the malignant tumor possesses to involve the tissues in its neighborhood, and have remarked that this tendency does not belong to the innocent growths; if, therefore, any adhesion or drawing in of the integument to the surface of the growth can be detected, the suspicion of its being a cancer may be entertained (Figs. 303, 304, and 305).

But we will now pass on to another symptom, which, if present, is most characteristic of the cancer; and that is, a secondary glandular, lymphatic enlargement; for if this symptom be present with a doubtful tumor, the probabilities of its being cancerous become very strong, for innocent and non-malignant tumors are rarely, if ever, attended with enlarged lymphatic glands.

A distinct and isolated tumor, therefore, which does not possess any of the special characters of a simple growth; which is attended with some evidence of secondary affection or infiltration of the parts, and with which an enlargement of the lymphatic glands in its neighborhood exists, may safely be regarded as cancerous. It is, however, only in the early stages of the development of a tumor that a difficulty in diagnosis is usually felt, for in the long-standing and well-developed growth the diagnosis, as a rule, is not difficult.

The soft, and so-called medullary cancer, is the form which is usually met with during young life; it makes its appearance generally suddenly, and often after the receipt of some blow or injury; it grows very rapidly, and presents a surface which is, as a rule, smooth and uniform, or of a semi-solid and fluctuating feel, and with large full veins wandering across. It is known by its sudden appearance, rapid growth, and uniform surface, points very different to those which simple tumors present, innocent growths being generally slow in their development, and more marked in their outline. The cases of medullary or soft cancer run their course very rapidly, and destroy life within a very short period of their development.

The hard cancers are the affections of middle age and adult life. They grow more rapidly than the innocent growths, seldom requiring more than a few months to establish their true nature; they seldom put on the external appearances of a simple tumor, and never exist long without assuming features which are more specially characteristic of cancer, the implication of neighboring tissues and secondary glandular enlargements being the chief points.

A cancerous tumor has therefore these peculiarities:

1. It has the peculiar power of infiltrating every tissue as it encroaches upon it.

2. It is prone to recur after removal.

3. It affects the lymphatic glands of the neighborhood.

4. It usually destroys by secondary deposits, that is to say, by the development of similar growths in the viscera or remote parts, the lungs and liver being particularly prone to its attack.

Cancerous tumors have been variously described by authors; the *hard*, as scirrhus or fibrous; the *soft*, as medullary; the *open, bleeding, soft* cancer, as "fungus hæmatodes;" the *black*, as melanotic; *skin* and allied cancers, as epithelial; *bone* cancers, as osteoid.

But all have the four special peculiarities that have been described as characterizing a cancer.

In these pages the cancers will be considered as scirrhus, medullary, melanotic, epithelial, osteoid.

Scirrhus Cancer is the most common; it is the usual form found in the female breast; it is seen in the testicle, tonsil, skin, bone, eye, rectum, or any tissue. It is the hard or fibrous form of cancer—"carcinoma fibrosum." When attacking a tissue either by infiltration (the most usual method) or deposition, it gradually encroaches upon the tissue; when this is a soft one it causes its contraction, as in the breast. The disease spreads outwards, and soon takes possession of neighboring structures by infiltrating them. In this way it becomes gradually less movable, and at last fixed. No structures resist its influence—fat, skin, muscles and bones becoming filled with cancerous elements as the disease progresses. It is said "to increase most on the side of the chief arterial supply, and in that towards which by lymphatics and veins its constituent fluids most easily filter" (Moore).

Thus the lymphatic glands become enlarged, and these in their turn may press upon nerves and cause pain, or upon veins and produce œdema. But cancers have not the power of living like innocent tumors, they are apt to degenerate and die, and thus, after a time, a cancerous tumor may soften down in its centre, and burst, or die as a whole and slough out, or ulcerate upon its surface. But, whatever happens, the disease still spreads in the neighboring parts; indeed, after the sloughing of a cancerous tumor, this spreading action in the bed from which it has been enucleated seems to be more rapid. Thus the death of one part of a tumor is seen with the rapid increase of another part, and in this way the disease goes on encroaching upon and infiltrating and destroying all tissues in their turn, destroying life either by exhaustion, hemorrhage, or some internal complication.

In some instances of cancer before ulceration occurs, the integument over the tumor, or about it, becomes infiltrated with small shotlike tubercles; such a tubercle feels to the finger in its early stage like a foreign body introduced into the cutis; as this grows it appears as a distinct skin tubercle. No clinical symptom is more characteristic of cancer than these skin tubercles.

In other instances the whole integument becomes œdematous and brawny, infiltrated, in fact, with cancerous elements, and when this occurs the most rapid form of cancer is present. This brawny condition of integument commonly follows venous obstruction from glandular enlargement, but at times it takes place before any such complication. In rarer cases the cancer withers, "atrophic cancer," the disease slowly progressing to a point and then disappearing by a gradual process. In this way cancerous tubercles will appear and disappear; cancerous nodules will form and fall off by the contraction of their own fibres. In this way cancer may become cured, or so stationary as not to interfere with life. I have a case now under obser-

vation in which the disease has existed for twenty-three years, and seems still local. I have recorded another in which the disease lasted twelve years, appearing and crumbling away almost to a perfect cure at times during that period. Cancers display a very variable degree of growing or existing power; and there does not seem to be any condition of the patient or the tumor that either favors or disfavors these properties.

Some have an apparent vigor of increase that is remarkable, whilst others show no such tendency; and in many cases a tumor that has been quiescent for a long period will suddenly take on active increase.

The same thing may be said as regards the *cancerous ulcer*. In the atrophic form of cancer this may be merely a superficial loss of substance on the surface of the tumor, which may be covered with a scab or present a glazed or very slightly discharging surface. In other cases the ulcer will present an irregular surface with an elevated everted edge infiltrated with new tissue (Fig. 309).

When a cavity exists, formed by the softening down of the centre of the tumor or enucleation of dead tissue, the irregular outline of the cavity, the fetid semipurulent sanious discharge, the ragged and infiltrated edge of the wound are characteristic.

In these cases a cachexia becomes visible, a pale bloodless haggard look of sorrow and suffering, brought on by pain, sleeplessness, and exhausting discharges.

Pain in the development of a cancer is a very variable symptom. In primary growths it is rarely severe, unless some nerve trunk be pressed upon, or the tumor is bound down by a tense fascia or is developed within a bone. Under all these circumstances the pain is constant, of an "aching or of a so-called rheumatic kind." In others it is usually compared to an occasional dart of pain through the part.

As a sign of secondary deposits pain is a valuable symptom, neuralgic pain following the course of any nerve being enough to excite fear of some deepseated secondary growth. No more valuable or reliable clinical symptom exists than this.

The *section* of a scirrhus cancer is generally attended with a grating sensation, the parts cutting crisply; it presents a *concave surface*, and yields on scraping a milky juice. It has no defined margin, the diseased and healthy tissues, as it were, dipping into each other. The surface of the cut portion may be vascular or bloodless, and present a bluish-gray or streaked yellow aspect, according to the amount of cell or fibre elements entering into its formation, or its progress towards degeneration; the yellow spots being indicative of degeneration. Occasionally cysts or rather cavities containing serum, blood, or broken-down tissues are found in the tumor, and at other times creamy saponified masses of degenerate tissue.

The microscopical appearances of carcinomas are well shown in Fig. 297.

Medullary Cancer, like the scirrhus, is either *infiltrating* or *tuberos*, and possesses, to a high degree, all the cancerous peculiarities. It is, doubtless, only a form of cancer and not distinct from the scirrhus varieties; for both often coexist, and the hardest primary cancer is generally followed by the soft in its secondary local or other growths. Medullary cancer is, however, the special form that appears as a congenital tumor attacking children and young adults; it may be called "the cancer of young life." These growths form very rapidly and run their course far more quickly than the harder kind. They increase so fast that they push the tissues with which they are surrounded away, more like the innocent tumors which separate them; their capsules prevent that general infiltration of the parts such as is found in the infiltrating form. It is found,

although rarely, in the breast, but more frequently in the intercellular tissue, and about the periosteum and bones. It is the usual form in the eye, uterus, tonsil, testis, and ovary; the bones and cavities of the head and face appear particularly prone to its attack.

These soft cancers usually appear as deep-seated swellings; when not bound down by fascia or connected with bone they are rarely painful; when so situated a gnawing pain or ache is then a common concomitant. As they advance and become more visible, they may either present a nodular lobulated aspect, or a smooth and uniform one; but under both circumstances the integument covering in the growth will be traversed by many very large and dilated veins; in some instances the growth has a bluish congested aspect, as if filled with venous blood (Fig. 305). These tumors are often so vascular as to pulsate and to simulate an aneurism; such a symptom, however, is mostly observed in those connected with bone.

To the hand the swelling feels soft and fluctuating, often giving the idea of fluid, and should the surgeon, to satisfy himself upon this point, puncture the tumor with an exploring needle, blood will freely escape and with it some creamy tissue, which under the microscope will be seen to be made up of cells and nuclei.

When these soft cancers have burst through their fascial envelopes they grow more rapidly, and when they have made their way through the skin they, as it were, pulp out, and project much as a hernia cerebri does after compound fracture of the skull, and bleed; the soft succulent granulations and blood-infiltrated tissues that project suggested to Mr. Hey, of Leeds, the term "*fungus hæmatodes*." When a soft cancer is filled with blood it is known as a "*hæmatoid variety*."

When this form of cancer springs from fibrous tissue, or periosteum, it is separated into sections by bands of fibres; when it originates in bone it is

similarly divided by their plates or outgrowths of ossific matter; these plates or laminæ being sometimes distinctly separate, at others so closely packed together as to form as it were a skeleton tumor (Fig. 291), the cancerous elements clothing the bony outgrowths or surrounding and covering them in. For diagnostic purposes the detection of these bony plates is of great value.

In cancer of the lymphatic glands these tumors develop to a large size. In the neck, axilla, and abdomen, they appear when fully formed as fixed semi-fluctuating growths with the ordinary characteristics already described; at first they may be as movable as any gland. When they appear in the parotid region they usually if not always produce paralysis of the facial nerve; a clinical symptom I



FIG. 291.

Prep. Guy's Mus.

think I may say never found in the ordinary innocent parotid tumor; when present, therefore, this symptom is of value.

As a rule, however, this soft cancer surrounds nerves and vessels without materially pressing upon them; large vessels and nerves being often found passing completely through their substance.

The section of a soft cancer differs from that of a hard, as the "infiltrating" differs from the "tuberos" (compare Figs. 306 and 307); and it differs likewise very materially in itself at different times. It may be firm or nearly fluid; it may be white and creamy, or red and blood-stained. It may be soft from inflammatory action or degenerating from natural decay.

Under all circumstances it will, however, be divided into lobules; fibrous septa or fibrous envelopes separating these lobules from one another, as the fibrous capsule of the parent growth separated it from the other tissues.

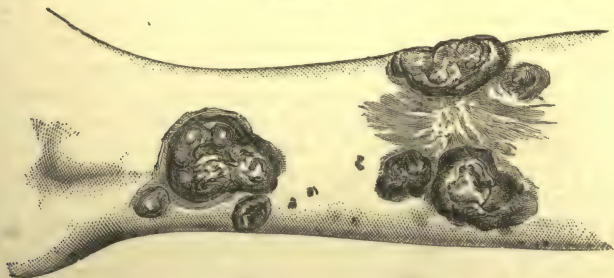
The material composing these cancers, says Paget, "is a peculiar, soft, close-textured substance, having very little toughness, easily crushed and spread out by compression with the fingers. It is very often truly brain-like, most like foetal brain, or like adult brain partially decomposed and crushed. Many specimens are, however, much softer than brain, and many, though of nearly the consistence of brain, are unlike it, being grumous, pulpy, shreddy, or spongy, like a placenta with fine soft filaments. Very few have a distinct appearance of fibrous or other regular structure."

These tumors when pressed or scraped yield abundant "cancer juice," and this juice is generally diffusible in water. No better rough test, says Paget, exists for the diagnosis of medullary cancers than this. The stroma of this cancer element is filamentous, and variably condensed; it is generally very vascular. The cell element always predominates, but these cells differ in no way in character from those found in the fibrous or scirrhus form. They are less closely packed together, and seem to be suspended in the juices of the growth or inclosed within its delicate connective tissue (Fig. 297).

Melanoid or Melanotic Cancer is essentially a medullary cancer containing pigment, having its origin in a natural tissue, as in the choroid of the eye, or in a mole, in which pigment exists; but what it is that determines the development of these growths in tissues that have had a lifelong existence has still to be explained.

These black cancers have, however, one peculiarity, and that is in their tendency to multiplicity—in this they are often most remarkable—the skin and subcutaneous tissue at times becoming studded with melanoid growths of all sizes and shades of colors. Fig. 292 is taken from a woman over

FIG. 292.



From Model, Guy's Mus.

whose whole body melanotic cancerous tumors were distributed, the disease having originated in a mole which I excised.

If it were necessary to adduce a forcible illustration of a pathological fact which is now pretty generally accepted by pathologists, the development of melanotic cancers might be made of great value; for the natu-

ral history of both these primary and secondary melanotic growths proves that a cancer when first developed in a part, in a measure partakes of the nature and peculiarities of that part, and even when repeating itself in the lymphatic glands and internal organs, still preserves the characters which it originally acquired from the seat of its primary development. This pathological truth, as has been already shown, is as applicable to innocent growths as to other cancers, but the natural history of the melanotic form is perhaps the strongest argument in its favor. A melanotic cancer always grows from a part which naturally contains pigment, and a mole is unquestionably its commonest seat. It may be, perhaps, that the secondary glandular enlargements, in their rapidity of growth, outstrip the tumor from which they originally imbibed their peculiar nature; nevertheless their true character is maintained and preserved unto the end. The soft or medullary cancer is the form with which the pigment is invariably associated, and I know of no exception to this fact. This cancer, as a rule, runs a very rapid course; an extreme example of melanotic cancer, indeed, presenting all the worst features of the other varieties. It has, however, peculiarities of its own, to which attention will be subsequently directed.

The *osteoid cancers* will receive attention in the chapter devoted to the tumors of bone. They are all, however, probably only modifications of the medullary cancer affecting bone. It may be mentioned, however, that exceptional cases are on record where an osteoid cancer originated in some intermuscular interspaces.

Epithelioma and Epithelial Cancer are terms given to a form of cutaneous cancer from its similarity in structure to the epithelial elements of the natural skin. In the chain of malignancy epithelial cancers are linked to the recurrent tumors, for they have both a tendency to return in a part after their removal, and to affect the system through the lymphatics; in exceptional instances they may be found in the internal organs.

These tumors affect the skin or mucous membrane, and never originate in any other tissue; but they possess this feature in common with the more malignant cancers, that they have a constant tendency to infiltrate the parts with which they come in contact, and do not, as innocent tumors, simply separate them. They are the common forms of cancer found in the lip, tongue, œsophagus, rectum, scrotum, penis, clitoris, os uteri, vulva, &c.; they may be described as the cancer of the skin. In sweeps it is known as the "chimney sweep's cancer." Epithelial cancer is essentially an infiltrating disease; it is not, as the sebaceous, fatty, fibro-cellular and fibrous tumors, a distinct growth developed in the tissues and separating them, but it is from its very beginning an *infiltration*. It begins, as a rule, in a wart or tubercle, and this grows; it may fungate, crack, fissure, or ulcerate, and when this latter stage has been arrived at, the careful examiner will at once observe its true character, for the integument forming its base and margin will be evidently infiltrated with the cancerous material, and will present the well-known raised, indurated, and everted edges (Fig. 111). These appearances form a marked contrast to the condition of integument which has been ulcerated or ruptured by over-distension in an innocent growth.

As a local disease, this epithelioma may slowly progress for years and cause little pain, inconvenience, or injurious influence; five, six, eight, or fifteen years have passed away in some of the cases before me ere advice was sought, and it may continue for many years before it affects a patient in other ways than by the local disease.

On the other hand, when it once begins to spread, it may do so rapidly;

when removed it may return at once, not only in the parts, but in the lymphatics of the district, and even in the internal organs. When it spreads locally, it may, as a cancer, infiltrate and invade every tissue as it touches it. I have seen it more than once originate in skin and end in the total destruction of a bone. The "rodent ulcer of the face" is essentially a cancer of this kind.

Epithelial Cancer is made up of cells differing but little from those of ordinary epithelium, but they are grouped very differently, infiltrating the tissues in which they are placed or clustered together in masses, these masses being described as "nests," which are only found in this affection. (Fig. 297).

The surface of an epithelial cancer may be dry and warty, or ulcerating; when ulcerating, it will be, like all cancerous sores, irregular, and discharging a thin or a creamy fluid. The edge will always be thick and elevated, like a wall of new tissue built up between the healthy and diseased structures; when it spreads it will invade and infiltrate every tissue, forming deep excavated sores. It may involve the lymphatic glands, as a cancer, and these glands may soften down, giving rise to a cancerous abscess or open sore, like other cancerous sores. It usually destroys life from local causes, and not from secondary infiltration of the viscera, it being exceptional for such a consequence to take place.

These cancers should always be removed, and the sooner this is done the better are the prospects of a cure or a long reprieve, for if any cancer has a local origin the epithelial has, and if it be removed before any glandular enlargement has taken place the prospects of a good result are great. Sibley ("Med.-Chir. Trans.," vol. xlii), made out from the Middlesex Hospital records that epithelial cancers, on the average, destroyed life in fifty-three months, while scirrhus lasted but thirty-two. When removed by the knife care should be taken to cut well free of the disease, for it is not unusual in this, as in all cancers, to find the tissues around the tumor sparsely infiltrated with cancerous elements, which, if left, would cause a return of the tumor. The same advice is applicable when caustics are employed.

In many examples of this form of cancer the removal by the galvanic cautery is by far the best method of treatment we possess, either as a cautery applied to the surface, or as a wire *écraseur* applied around the base.

Colloid Cancer is hardly recognized as a special disease, for the term colloid is applied to tumors made up of intercellular spaces of variable sizes, filled with a clear glairy fluid, like glue, that contains abundance of granules and large nucleated cells (Fig. 297). The clinical history of some of these growths is that of an innocent tumor, whilst in others it is that of a cancerous one. Colloid tumors are found in the breast, parotid region, ovary, rectum, and intestinal canal. In this last region they are known as the alveolar or gelatiniform cancer. Its true nature is not yet fully understood. The term has at present little clinical significance.

Villous Growths may be cancerous as well as benign. When made up of cell-elements their cancerous nature is to be suspected, but the fact is only to be made out by the clinical career. Mr. Sibley, in the "Med.-Chir. Trans.," vol. xxxix, and "Path. Trans.," vols. vii, viii, and ix, has very ably discussed the nature of villous and colloid disease.

The Causes of Cancer.—These are most obscure. *Local injury* at times appears to have a very marked influence in determining the seat of a cancer, but it is quite exceptional to obtain any such history. *Hereditary influence* has always been looked upon as a very decided cause, but in how small a proportion of cases of cancer can any such be found! Sir J. Paget traced

it in one out of every four cases; Mr. Sibley in one of every nine; and out of 222 cases of my own it was traceable only in one of every ten instances. In many other affections, even the most innocent, as large a proportion might be found. In fatty tumors all surgeons recognize the frequency of an hereditary history. Indeed, looking at cancer as one of many diseases, there is no reason to regard it as being more hereditary than any other.

Cancer is, however, a disease of adult life, and is most prone to attack an organ that has passed through the active period of its existence and is degenerating. When it attacks an organ in the full vigor of its functional activity, it partakes of that activity and runs its course with marvellous rapidity.

Cancer appears to be in its origin a local disease, and to become general by dissemination of its elements—dissemination at first radiating from its local source and at a later period becoming general through the fluids of the body. Moore, in his work on "The Antecedents of Cancer," and De Morgan more recently, have, I think, established this fact. From a clinical point of view, this is, without doubt, of very practical significance, for surgeons now admit that the earlier a cancerous tumor is removed the better are the prospects of a cure or of a long immunity from the disease.

Treatment of Cancer.—The *general treatment* of cancer resolves itself into the improvement of the general health, and the nutrition of the body by hygienic means, good nutritious diet, and tonic medicines. No medicine has any special influence on the disease.

The *local treatment* may be summed up in the word removal, for all cancers should, if practicable, be taken away as soon as formed, that is, as soon as their true nature has been established. In the early stage of a cancerous tumor, before the diagnosis has been made out, it should be protected from external injury, from all irritating causes. No rough manipulation should be allowed, nor any movement of the muscles that surround or influence it. Warm or hot applications should be avoided, for there seems reason to believe they encourage its growth. The acutest cancer of the breast I ever saw was one that originated as a chronic infiltration, and was made active by the application of hot fig poultices for a week; the gland itself and skin over it to the limit of the application became infiltrated to an extreme degree with cancer, which rapidly broke down, and destroyed life. The best protective application is cotton-wool.

Moore used to think highly of the local application of the iodide of lead and opium ointment, applied on lint to the tumor; he believed it had some influence in diminishing and retarding its growth. Some surgeons have faith in iodine as a local application; I must confess that I have never been able to make out that any of these or other applications had the slightest influence in checking the progress of a cancer and have discarded them. When pain is present the belladonna extract rubbed down with glycerin into a fluid the consistence of treacle, or of the extract of opium similarly diluted, seems to be a valuable application; and an opium or belladonna plaster spread on leather gives comfort and protects the part.

When the diagnosis is established, the tumor should be removed, and the best method is, doubtless, that by excision; delay being only justifiable when the general condition of the patient forbids the attempt. To delay is only to increase the risk of a local dissemination of the cancerous elements, and thus diminish the prospects of a successful result; to give time for the lymphatic glands to become enlarged, when removal of the primary growth becomes of less value; and to increase the chance of some internal or remote organ becoming involved, when all operative interference must be futile.

In removing a cancerous tumor the surgeon should not be too sparing of surrounding tissue; when it is encapsuled there is no necessity for doing more than enucleating the mass, but when it infiltrates an organ the only correct treatment is the removal of that organ, and in removing the organ care should be observed to take away all skin that is in any way adherent to its surface, and as much of the surrounding fat as circumstances will allow.

When the tumor has been removed all surrounding parts should be carefully examined, for it is not uncommon to find small cancerous tubercles in the connective tissue, fascia, or muscular sheaths, that if passed by unheeded would soon grow and give rise to a recurrent growth. Indeed, it is from these points that such recurrent growths probably often arise, and these the surgeon, by care and observation, may often prevent. De Morgan, after excision of a cancerous tumor, washes the wound with a solution of chloride of zinc, twenty grains to an ounce, to destroy the cancer germs. The surgeon had better remove all skin, and allow the wound to granulate up, than save integument which is of doubtful integrity for the sake of making an apparently more complete operation. When lymphatic glands are enlarged and can be removed at the time of operation, they should not be forgotten; they should be enucleated by the fingers or handle of the scalpel rather than be excised; their capsules should be divided and the glands turned out.

Cancerous tumors of the tongue, penis, clitoris, labium, neck of the uterus, &c., may be removed by the wire or chain *écraseur*, either with or without the cautery, but this subject will receive attention in other pages.

When a cancerous tumor cannot be excised or the cutting operation is rejected, it may be removed by caustics; but this method is more painful, slower, and not more successful than excision. When employed as a substitute for it, it is, like all substitutes, only second best; it is, however, applicable where excision is not. The French surgeons do this by inserting around and into the tumor thin conical flat wedges of chloride of zinc made into a hard mass with flour or plaster of Paris, holes being made into the tissue for the introduction of these *flèches* by the scalpel. Maisonneuve is the chief practitioner of this school.

The "caustic arrows" of M. Maisonneuve are composed of wedge-shaped pieces cut from a thin cake of paste made by mixing one part of the chloride of zinc and three parts of flour, with as much water as may be found necessary. These pieces or arrows are dried, and they may be kept in a bottle for a long time without injury.

In England this plan finds little favor; the following method is more general: In a tumor that is not ulcerated let the skin be destroyed by the application of some strong sulphuric or nitric acid, and in this slough let one or more incisions be made; into this let a paste of chloride of zinc and flour mixed with the extracts of the *sanguinaria Canadensis*, and stramonium, be introduced, fresh incisions being made through the thickness of the slough thus formed every other day, and fresh paste inserted; in this way the whole tumor may be destroyed or enucleated. The paste is a modification of that introduced into London by Dr. Fell, of the United States, and is, without doubt, the best working caustic paste we possess. The following is the way to make it:

Boil down to a liquid extract some decoction of the *sanguinaria Canadensis*, and with an ounce of the extract dissolve an ounce of the chloride of zinc. Mix this with two ounces of the extract of stramonium, and a soft paste is ready for use.

Canquoin's paste is composed of chloride of zinc and flour in equal parts,

a few drops of water being used to make it into a paste. A second form is probably better than this: Chloride of zinc one part, muriate of antimony one part, flour one part and a half, water a few drops. This paste is of the consistence of soft wax.

When the tumor is ulcerating or open, there is no necessity for the primary application of a liquid caustic. The paste may be applied directly to the part, and fastened on by cotton-wool and strapping; a thickness of half an inch applied for twelve hours usually produces a slough an inch deep.

Some surgeons prefer a solution of chloride of zinc alone inserted on cotton-wool. M. Rivallié uses nitric acid applied on lint or asbestos; Velpeau, sulphuric acid on saffron. In some cases the Vienna paste is preferred. Arsenic as a caustic has had its day—it is dangerous and less effective than zinc.

For cutaneous epithelial cancer, the caustic treatment is the best. The chloride of zinc made into a paste with flour, or with sanguinaria, may be used according to fancy. The *potassa fusa* is likewise a useful form. When the galvanic cautery can be obtained epithelial skin cancer may be readily destroyed. I have burnt down many affecting the nose, cheek, eyelid, scalp, hand, arm, lip, and other parts; by it a large surface of diseased tissue may be completely carbonized and a healthy surface produced after the removal of the eschar. The operation should be performed with the aid of chloroform, and the whole thickness and edges of the diseased tissue destroyed. The after-pain is very slight, the cautery destroying all nerve sensibility. It is by far the best mode we possess of dealing with skin cancer, more rapid in its action and certain in its result, besides being far less painful than any other. When the structure is deep it may be taken off with the scalpel and the base of the sore cauterized. No more efficient mode of removing a skin cancer than this is within our reach.

The treatment of tumors by injection of fluids into their substance, as originally suggested by Sir J. Simpson, and more recently practiced by Dr. Broadbent, has in it the elements of a successful plan, but has not yet been brought to any available state of perfection. Fatty tumors may be destroyed by the introduction into their substance of a few drops of deliquescent chloride of zinc, but cancerous tumors do not appear amenable to a like plan. Dr. Broadbent believes that he has succeeded by injecting a liquid composed of one part of acetic acid and three parts of water; and Messrs. Moore and De Morgan assert that they have each succeeded in obtaining gradual diminution of cancerous growths by these means. I tried the plan in twenty cases, when it was first introduced, but never found any good result ensue from it; it was often very painful, and many patients refused to have it repeated, although they asked for the excision of the growth. More recently the injection of twenty drops of a solution of bromine dissolved in spirit, \mathfrak{xxv} to a $\mathfrak{3j}$, has had its advocates.

The treatment by pressure is of no practical value.

By way of summary, it may be stated that cancerous tumors should be excised when practicable, and the sooner the operation is performed, after the diagnosis is clear, the better. That removal by the *écraseur* is equivalent to excision.

That open cancerous tumors had better, as a rule, be treated by caustics, or by enucleation; the best caustics being those which contain chloride of zinc.

That for skin cancers caustics are, as a rule, the most available, although excision in some instances, as in the lip, is to be preferred; that the gal-

vanic cautery, however, should be employed when possible, it being the most rapid and efficient destructive agent we possess.

Virchow, "Die Krankhaften Geschwülste," 1862-5.—*Paget*, "Surgical Pathology," 1870.—*Abernethy*, "On Tumors."—"Pathological Society Trans"—*Wilks*, "Pathology."—*Billroth*, "Éléments de Pathologie Chirurgicale," 1868—*Holmes*, "System of Surgery," 1870.

CHAPTER LXV.

ON THE MICROSCOPICAL ANATOMY OF TUMORS.¹

Two distinct processes are observed in the construction of our bodies. First, the production of the elementary pieces, by whose compilation the fabric is composed; and second, the disposition of these elementary pieces into certain forms and shapes suited to the requirements of the part to be made. These two processes are as distinct from each other as making bricks is from building; we may call them construction in the first degree and construction in the second degree. The several kinds of flesh of which the body is composed have each its own character in regard of both these constructive processes. They have peculiar elements, and these elements are disposed in each tissue in a manner proper to that tissue. I need not instance examples, the fact is so familiarly true throughout physiological histology.

In the general consideration of the genesis of tissue these two constructive processes—the elementary and the compiling—take their place as in one aspect natural and necessary, and in another forming the chief among other proofs of wisely adapted design operating on principles which are so far continuous with our own plans of acting that they fall within our intelligent comprehension, and put the mind in harmony with the machinery by which it becomes active.

But in the construction of morbid products shall we find the same two distinct processes still in operation? This question touches the history of opinion and knowledge of morbid growths very extendedly. To be short, however, no doubt it is only of late years that it has come to be fully appreciated how construction of the second degree is involved in the development of tumors.

They were formerly aware that in the healing of wounds the new materials are made in the likeness of the parts which they adjoin, and whose function they supplement and in due time discharge. But this transformation of newly produced matter to the nature of the tissue adjoining was regarded, so far as it was regarded at all, as in some way the effect of the neighboring part. And this, which, indeed, instances plainly enough to us the production and construction of new elements in adaptation to each other for proper purposes, was not regarded by them in this light, if regarded at all, so that the production of the element and its use in construction of organized forms were not separated as two distinct histological processes. Do we not need to distinguish these processes more plainly even now in our own time?

¹ This chapter, in its entirety, has been written by my friend and colleague, Dr. Moxon.

The early view of new formation in the body as an undefined coming was succeeded, when the microscope was employed as a means of discovery, by a view looking only to construction in the first degree which coarse microscopical examination discovered; and for a long while it was, and with some still is, the only question, what is the character of the component cells of the tumor? As if in the study of buildings one were asking what is the sort of bricks or stones they are made of. True, this would serve to divide them into brick, stone, concrete, and mud buildings, or in our matter into fatty, bony, fibrous, &c., tumors; and we must not despise such an advance, which is a real step forward, by comparison with entire ignorance of structural composition.

But now we no longer confine attention to the component cells of tumors; rather in the study of them we have a main regard to the mode in which they are put together, and the degree and kind of organization which is undergone in the raising of them into often truly complex fabrics, such as we find many tumors to be when their organization is properly apprehended.

It will naturally be asked, do the pathological tumors evidence any new plan of building, or are they always on the plan of some natural type? is there anything new in the nature, or, if I may so speak, in the conception, of any pathological tumor? The answer which has the greatest authority, that of the illustrious Virchow, on its side, is that there is nothing new in the plans of construction of tumors, but that all tumors are formed of substances natural to the body.

It has long been well known that a large proportion of tumors, especially those which show the most innocent disposition, have a structure like that of some healthy tissue. And this induced the naming of tumors after the tissue that they resemble, *fatty, fibrous, bony, &c.*, or, as they are called, Lipoma, Fibroma, Osteoma (the termination -oma is now universally chosen to express tumor with structural resemblance to the tissue called by its prefix). Virchow's doctrine of the constant homology of every new tissue with some tissue natural to the body, has induced him to carry this classification of tumors further than it was hitherto taken (unfortunately his book remains incomplete, and in some of the greatest difficulties the subject remains wanting his help). As a method of arranging tumors it is convenient, whatever may be said about his position, that no new substance can arise in the body. I believe that this statement should be taken along with a counter-proposition if we would have a true view of the matter. Granting that whatever arises in the human body must be a human accident, so that feathers or cherry-stones will not develop in it, yet we must also see that the expression of all human accidents is not completed in the healthy man, but rather by elaboration and variation out of him into something else different, though still human. Positively all intermediates between his healthy tissues might be expected, and indeed many intermediates do arise which sufficiently show how wide a scope this possibility allows.

Indeed, it should be forcibly said that while those assumedly natural tissues found in tumors are really like the natural tissues of the healthy body in general description, yet they in all or almost all instances will be found to have differences in the building up of the elements, or even in the elements themselves, which make the common identification of them with the tissues they resemble to take rank as only a convenience, and not the whole truth of the matter.

Indeed, this proposition I would lay down with confidence, that no morbid growth is ever found which has not in it sufficient peculiarity to dis-

tinguish it from all natural tissues, which peculiarity is to be looked at by those who would explain its characters and history rather than that they should exclusively regard those features it has in common with natural tissues. The practically important side of the matter is that osteoma is not bone, and enchondroma is not cartilage, and lipoma is scarcely fat. Nevertheless it is very convenient to be able to classify tumors by their structural *likeness* to the natural tissues developed or in course of development. Yet it is only in this sense as like, but not identical, that the grouping of tumors to correspond with the grouping of natural tissues is here practiced.

Malignant Cancer.—The question must be dealt with, what is the relation of the common clinical division of tumors into cancers, recurrent and simple tumors, or into malignant, semi-malignant, and benignant tumors, to the histological structure of the tumors? We will shortly consider these divisions. Simple or benignant tumors are those that have no malignancy, and recurrent or semi-malignant tumors are those which have only a partial malignancy, so that we have only to consider as a *positive* matter what it is for a tumor to be malignant or to be cancer.

Malignant.—In a very common yet vague sense the term malignant is applied to any fatal tumor, superficial or internal. There is no defence for this except from colloquial convenience. These fatal tumors certainly are not easily viewed as benignant or innocent. And so this common use of the word malignant arises through making innocence the positive, and regarding all that are not innocent as deserving by negation the opposite term. But as I have said, malignancy is the active and positive thing to which innocence stands as a negative.

What are the active and positive characters and behavior of a tumor that get it the name malignant?

A tumor obtains the name with different authorities from two rather distinct points of view.

First. Paget, for instance, has regard to the *descriptive peculiarities* of the more destructive kind of tumors, and hence describes malignant tumors as follows:

"1. The intimate structure of malignant tumors is, usually, not like that of any of the fully developed natural parts of the body, nor like that which is formed in a natural process of repair or degeneration.

"2. Malignant growths may have the character of infiltrations; *i. e.*, their elementary structures may be inserted, infiltrated, or diffused in the interspaces and cavities of the tissues in which they lie.

"3. It is, also, generally characteristic of malignant tumors that they have a peculiar tendency to ulcerate, their ulceration being preceded by softening.

"4. The softening that often precedes the ulceration of malignant growths can hardly be considered separately from the minute account of their structure. I therefore pass it by, and proceed to their fourth distinctive character, which is to be noticed in the modes of their ulceration.

"5. Malignant tumors are, again, characterized by this: that they not only enlarge, but apparently multiply or propagate themselves, so that, after one has existed for some time, or has been extirpated, others like it grow, either in widening circles round its seat or in parts more remote.

"6. A sixth distinctive character of malignant tumors is that, in their multiplication, as well as in their progress of ulceration, there is scarcely a tissue or an organ which they may not invade."

Second. Another class of pathologists regard rather the *properties* of the tumors which have been discovered as giving rise to those clinical peculiar-

ities which Paget so well describes; and hence say that a malignant tumor is one (1) which infects the neighborhood, so as to show its offsprung elements in the tissue around, so that it (2) recurs after removal, because its seed was left; and (3) also extends to the lymph-glands along the lymph stream, and (4) to the great vascular viscera, or to points in the whole blood-carrying system, by infection of the blood stream. In short, these pathologists reduce the word malignant into a compass which would be exactly expressed by such a bad compound word as auto-infectious.

Now, the compass of these two several lines of application of the word malignant is much the same. One describes what the other explains; the other explains what the first describes. If we are to decide which is the better, it must be settled by observing whether description or explanation most usefully determines the kind of a tumor. I think description must be widely and laboriously detailed to reach the expression of signs of malignancy, and that the learner will scarcely carry descriptions which could fortify him against mistake. On the other hand, the conception of malignancy or auto-infectiousness is at once grasped, and, if discreetly used, will generally serve to give a sufficient clue to the nature of any given tumor.

Thus, in any tumor of the breast, the inquiry on one system will be—"Does it push parts aside, or grow into them?" On the other—"Is the skin, &c., stretched over or involved in the tumor?" This, you see, is the same question.

Again, on the one system the question will be—"Does the disease infect all through to the surface, and then open on it?" On the other—"Is the skin simply stretched, perhaps burst through, and does the tumor simply thrust out itself, while healthy skin awaits its chance to heal? Or is the edge of the opening thick and everted, and callous with such and such an ulceration?" This, again, is the same question. But repeating, as the student can, such ways of considering the characters of innocency, he will, I believe, soon learn to value the short comprehensive and comprehended grasp of them by the consequences of their auto-infectiousness, by means of which he can infer or explain the more tedious descriptive terms.

Cancer.—The word *cancer* is best regarded as the substantial equivalent of the word malignant, so that a tumor that is malignant is a cancer, and a cancer is a malignant tumor. If we accept this, there is no longer any need of discussing the compass of the word cancer; and, indeed, now and always, this has been the most ready and natural use of the word, and that most universally employed. For if you watch the writing or speaking of any one who, priding himself on descriptive accuracy, limits cancer to carcinoma, you will invariably find that before long he is using the word cancer as the equivalent of malignant.

On the other hand, the word cancer is made by some to be the equivalent of carcinoma; while the latter has a limited application to a certain kind of tumor structure (see Fig. 297). Surely this is superfluous. The word carcinoma is enough for its proper application, and in pathological questions of precision there is no hurry or vagueness to prevent the employment of four syllables. So I think the word cancer may be left to its colloquial wide signification as a malignant tumor of any sort, carcinomatous or otherwise. Certainly, tumors of various histological structure do prove auto-infectious or malignant. The tumors which most frequently show this malignancy are in order—(1) Carcinoma in all its forms, (2) Sarcoma, (3) Myxoma, (4) Lymphoma. Other structures, also, are far from being free of the risk of auto-infection.

Recurrent or Semi-Malignant.—Auto-infection is, in some kinds of tu-

mors, rare or incomplete in its manifestation. Thus, some spindle-cell sarcomas will recur often after removal, and yet show little tendency to invade the internal parts. Then, again, squamo-epithelial cancer extends to the glands, but not generally to the viscera. Also, soft, quickly growing sarcomata will extend fiercely to the viscera, and not invade the glands at all. In other words, auto-infection, in its three kinds, viz., infection of site, of gland, and of viscera, is not seen equally in all the sorts of infectious tumors. This is significant, and needs working out. It is convenient to call imperfectly malignant tumors semi-malignant. Sir J. Paget proposed the term recurrent fibroid for spindle-cell sarcoma, and its use was at one time general, but is now giving way to the more systematic term. Some classification of the partially infectious tumors by their kinds of infectiousness may be agreed upon, but as yet the time has not come for it.

OSTEOMA, OSTEOID CHONDROMA, ENCHONDROMA.

FIG. 293.



When bone forms a large part or apparently the whole of a tumor, the tumor is called an osteoma; but no tumor is ever formed altogether of bone, there is always present an ossifying matrix by the ossification of which the bony part of the growth enlarges. The kind of matrix varies much; thus, sarcomata or even carcinomata may directly ossify, and so we get *osteo-sarcoma* and *osteo-carcinoma*; but the forms of matrix which produce growths of practically a bony nature are generally two, viz., periosteum and cartilage. Periosteum, or to speak more exactly a tissue resembling closely the deeper layer of the periosteum, forms large tumors whose transformation into bone takes place in the manner shown in the left side of the above figure; the cells take the shape of bone-cells, and the matrix calcifies; these tumors are called *osteoid chondroma* or *periosteoma*.

Cartilage often appears to be ossified when it is only petrified by deposit of calcareous salts in its matrix (see right side of Fig. 293); this change is, as is well known, the first step in ossification of cartilage. In many cartilage tumors the process goes no further, or it may proceed through the several stages shown in the right side of the figure, viz., vacuolation, formation of medulla-cells, in the vacuoles, and direct transformation of these to bone-cells, as seen in the lower and right part of the

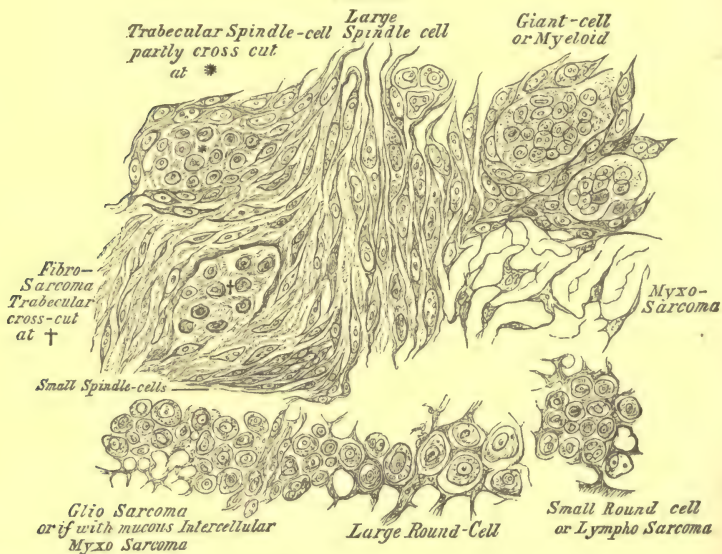
drawing. More rarely the cartilage-cells, without calcifying, proliferate and change directly into bone, as seen in the middle of the figure.

The amount of cartilage, periosteum, or bone present varies indefinitely in different cases. When cartilage preponderates the tumor is called an *enchondroma*; when bone preponderates, an *exostosis*, *osteoma*, &c., according to its shape and connections; when periosteum preponderates, an *osteoid chondroma*, as before said.

Occasionally the amount of bone and cartilage is so equal that it is a matter of difficulty to decide which name shall be used; and then the terms *cartilaginous exostosis*, or *ossifying enchondroma*, are employed. *Osteoid chondroma* is to be suspected of malignancy; it makes a part of what were called *osteoid cancers*.

SARCOMA.

FIG. 294.



The above schematic figure is composed of accurate drawings of portions of the several kinds of sarcoma named, but they are gathered together in a diagrammatic way, the forms being graduated into each other as they are when found side by side in the same tumor.

The distinctive histological character of *sarcoma* is the possession of a stroma between the cells, an atmosphere of intermediate matter which surrounds each and is between them all; the qualities of this intermediate or "intercellular" matter determine the kind of sarcoma.

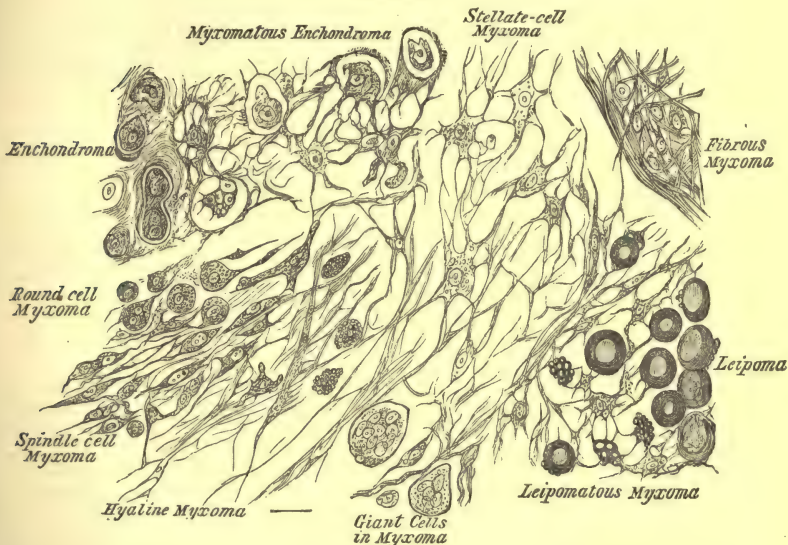
The relation of sarcoma to the connective class of tissues appears to be this, that when one of these tissues is produced very rapidly it has no time for its intercellular matter to acquire the proper characters of it, so remains indeterminate, while it also is small in quantity, the cells greatly preponderating. Thus, any of the normal connective tissues may produce by rapid development a tumor of sarcomatous tissue or sarcoma (the name is well chosen, *σαρκῆς*, which equals *caro*, or our word *flesh*, means commonly any soft animal substance, not blood nor bone). Thus it follows that there are several kinds of sarcoma, according to the tissues of which they are a development. The principal of these are seen in the above schematic figure. The round-celled kinds generally arise from lymph-gland, or neuroglia, or mucous tissue, hence they are common in myxo- or glio- or lympho-sarcoma. The spindle-celled kinds arise from connective, fibrous, or bony tissue, and hence are most common in fibro-sarcoma or osteo-sarcoma.

MYXOMA.

The name myxoma is given to all tumors of connective tissue type (not epithelial) which contain mucus or mucin in their intercellular matter. It corresponds nearly

to gelatinous sarcoma, collonema, and fibro-cellular tumor of older authors; the forms of the cells are very variable, but in the most typical examples, and especially in the older and fully developed parts, the cells are large and usually multipolar or "stellate," with a distinct nucleus and nucleolus; the stellate branching rays of the cells are mutually connected, so as to form a more or less open network, in the interstices of which the mucous semi-fluid lodges. Beams and bands, which generally have a stiff rigid appearance and an angular rather than a wavy disposition, pass about, dividing up the substance of the tumor into very imperfectly defined sections, more or less visible to the naked eye; from these arise fine fibrils continuous with the cellulo-fibrillar network. Much of the tumor, and especially the younger part, may be found formed of spindle-cells; these are really connected, by threads from their sides, with the intermediate fibrillar network, and it can often be seen that the stellate forms are produced by the drawing out of these threads to greater lengths,

FIG. 295.

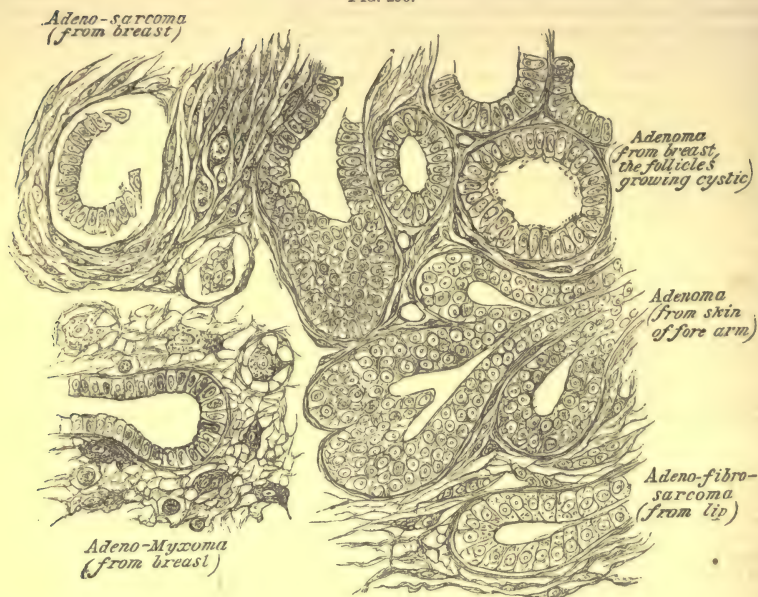


by the separation of the texture-elements, by the increasing quantity of mucus. In yet other examples or parts the prevailing form of the cells is round, or with one pole; the round cells resemble ordinary mucous corpuscles, and are scattered among the fibrils in the mucoid matter; they often contain many fat-grains, and are found in the oldest parts of the tumor, representing the senescence of its cells. There is also a great variability of the intercellular substance, first, in proportion of the fibrous to the cellular part; and second, in the proportion which these solid elements bear to the mucoid interstitial matter; thus, there is a fibrous myxoma, and a clear pellucid variety, with much mucous fluid, perhaps even forming cysts (hyaline and cystic myxoma). In some examples there are large polynucleated cells, identical with the so-called giant cells of "giant-cell" sarcoma.

In the theory of types, myxoma is affiliated to certain natural tissues, in particular the jelly of the umbilical cord, the vitreous of the eye at a stage of its development, and the early stages of adipose tissue, as well as a stage of bone formation out of cartilage. It will be seen that these typical tissues are only transitory in their nature, as compared with such stable tissues as bone, cartilage, tendon. In accordance with this instability of their type, myxomas themselves show many transitions to many kinds of connective tissue; these transitions are chiefly towards cartilage or fat (myxomatous enchondroma, myxomatous lipoma). Tumors are not infrequent, especially in the parotid region, which are intermediate between cartilage and mucous tissue, so that one cannot say to which they most properly belong; also, many fatty tumors show clear gelatinous patches of mucous tissue in all transitions to fat, while many myxomata show opaque spots composed of true adipose tissue.

ADENOMA.

FIG. 296.



The essential character of adenomas lies in the possession of a glandular structure; but the comparative amount of the glandular element varies much. There is also variety in the kind of tissue which is found between the gland-follicles. Some tumors show structure identical with that of compound racemose glands; more commonly the follicles are dilated more or less, so as to form cysts; one or more of these may prevail so as to give a cystic character to the whole (cystic adenoma). Besides the cysts arising in this way, others may be formed by a breaking down of the intermediate tissue, especially if it happen to be mucous tissue. More frequently the glandular elements are surrounded and separated by a new formation, which may be so much developed as to more or less entirely take away the glandular character of the growth; this interstitial tissue may either be fibrous, sarcomatous, or mucous, or more rarely cartilaginous or areolar; or it may present characters combining these or mediate between them (*adeno-fibroma*,—*sarcoma*,—*myxoma*). When the proportion of gland is small, there is doubt whether it is not part of the original gland-tissue persisting in the new substance; thus, the relative augmentation of the cavities of ducts or follicles may make the tumor take the character of cyst, or the relative augmentation of the intermediate tissue may make it take the character of sarcoma, myxoma, or fibroma; but if the glandular substance is maintained in due proportion, the natural resemblance of adenoma is to carcinoma. These, however, show larger nuclei in their cells, and the nuclei have thick outlines and contain many nucleoli; the cells are of more varied forms, and make usually compact columns and bulbs rather than follicular cavities.

CARCINOMA.

The term carcinoma is now distinctly applied to such tumors as have a structure of the following description, viz.: A meshwork of fibrous or sarcomatous substance composing an alveolar structure, whose interstices are filled with cells. These may have no orderly or methodical-looking arrangement, being packed in the crevices in the meshwork (or alveoli, as they are called), and extending casually from alveolus to alveolus, so as to make a complementary meshwork. The carcinomatous character is determined by the presence of such alveolar structure, with cell-collections lodged in it; the decisive point consists in these cells lying close together

without any intercellular substance; the cells generally vary in shape, and have large nuclei, with large and bright nucleoli. But often the cells have an arrangement very like the epithelial lining of the follicles of the secreting glands, a structure which may be so well pronounced as to bring them almost into continuity with adenomas; they differ from these chiefly in their history as being infectious, so as

FIG. 297.



Five leading types of carcinoma may at present be conveniently distinguished.

1st. Those in which the fibrous meshwork is in preponderance, and the epithelioid contents of the alveoli are scanty, and, perhaps, also prone to perish early, so that they are found more or less degenerate within the fibrous meshes—Hard Carcinoma, or Scirrhus.

2d. Those in which the fibrous meshwork is in smaller proportion, and the epithelioid contents are plentiful, making large collections of cells, but with no evident approach in the form of these collections to the shapes of gland-acini, and no evident resemblance of the component cells, either to the columnar epithelium of mucous glands, or the squamous epithelium of cuticle—Soft Carcinoma. This kind occurs especially in glands, and the transformation of the glandular tubes or follicles to cancer alveoli can be seen in all stages in the growing margin of the tumor (see the upper two drawings in the figure, from the liver and kidney).

3d. A structure essentially such as that last described, but with this difference, that the epithelioid cells have a quantity of mucus between them, which is regarded as arising from a transformation of them. This change to mucus may be carried to such an extreme that scarcely any cellular elements are left, while the alveolar meshes in which the mucus is contained becomes very strikingly visible from its nakedness and the pellucidity of the mucus—Colloid, or Alveolar Cancer. A common seat of this is the wall of the alimentary canal, where it may be traced arising from Lieberkühn's follicles.

4th. A structure in which the epithelial cells resemble squamous epithelium, and form masses which are very like the follicles of cutaneous glands, or occasionally like rudimentary hairs; the tubular and bulbous forms may, however, be seen ramifying like the lymphatic vessels of the skin, as if their form were moulded to the lymphatic plexus. In these cancers peculiar bodies are found, composed of flattened cells disposed concentrically so as to form a scaly-walled globe, whose appearance is like the section of an onion, or like a bird's nest; these are so large as often to be visible to the naked eye; when they are numerous and well characterized, they are diagnostic; some authors (Billroth) distinguish a variety of this cancer in which the stroma preponderates over the epithelial part, calling it scirrhus of the skin—Squamous Epithelial Carcinoma.

5th. A structure in which the epithelial cells resemble ordinary columnar epithelium, and the structure itself is quite like normal mucous membrane, in which it always primarily arises (alimentary canal, especially colon, uterus); the secondary formations which occasionally occur in these cases, in the liver especially, have the same structure, and thus a tissue like the glandular mucous membrane of the colon may be found in the liver—Cylindrical Epithelial Carcinoma.

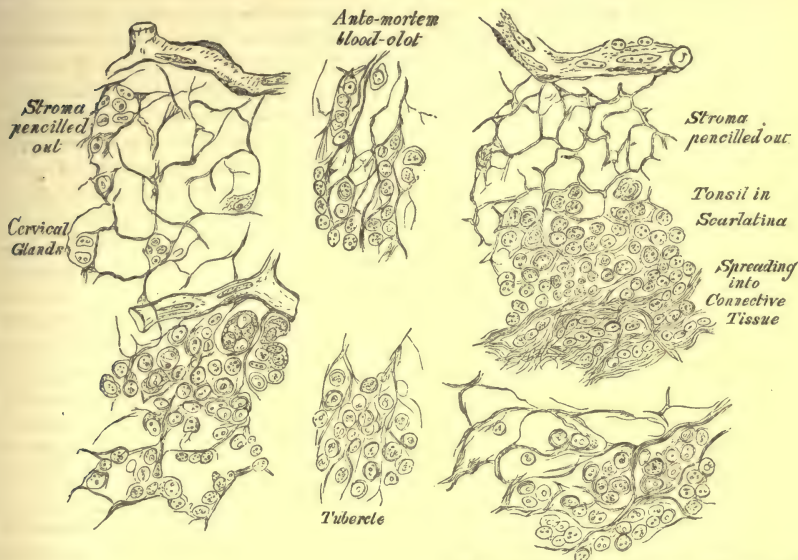
The fourth and fifth varieties are distinguished from the three first as epithelial cancers or epitheliomata. Some authors have used the term *cancroid* for the fourth variety, as though it were not completely cancerous. These are less likely to infect the viscera than the first two varieties, which are the most infectious of all tumors, though they are very far from being the only kinds of infectious tumors.

LYMPHOMA.

The name lymphoma is given to such growths as have a microscopic structure like that of lymphatic glands; in particular, which have a finely reticular meshwork, connected with which are some fixed cells at tolerably regular intervals, not unlike the fixed cells of connective tissue, but generally larger. Within the meshes of this network are numerous cells, which resemble lymph-cells, and hence are also like pus-cells and white blood-cells. The proportion of network to the contained lymphoid cells is variable; sometimes the quantity of fibre is great, and the structure is then like lymph-gland tissue hardened by chronic inflammation. In other cases the proportion of cells becomes very large, while the network grows very delicate and open-textured. The fixed stellate cells here appear to multiply, and produce a progeny of the loose movable cells in the meshwork, as if infected by the latter. The whole mass then appears as fine filaments making bold meshes, which are filled with round granular cells, the lymph-cells, but generally larger, and having large nuclei and many bright nucleoli. These cells at first appear to make up the whole substance, but they easily brush or wash out of the meshes, leaving the network very conspicuous. It will be noticed that the degree of structure here described is very rudimentary. Indeed, sections of ante-mortem blood-clot from within a vein (see figure) closely correspond to the description. So also does tubercle in the more recently formed outer edge of it, where its texture is very like blood-clot; hence it is by some classed with lymphoma. Scarlatinous tonsils and

typhoid Peyer's patches likewise have lymphoma structure. However, the plan of structure is so meagre that it is not enough to form a bond of union between diseases clinically so remote.

FIG. 298.



When found in the form of tumors, more properly so called, lymphoma generally takes its rise in the lymphatic glands; those of the neck are especially liable to it, then those of the abdomen and of the mediastinum. It is also found in the alimentary canal, especially the small intestine and stomach, and in the spleen, liver, kidney, &c. Formations of a similar structure have been met with in various organs in leukæmia, chiefly in the liver, in the form of small grains of a pale substance.

Lymphoma may prove malignant, that is, infectious to parts around, especially when the cellular elements are very numerous (in which case the tumor is called lympho-sarcoma by Virchow); it then corresponds to a part of what used to be included under the whole name medullary cancer, which, as formerly used, would include also soft sarcoma and soft carcinoma. Indeed, these tumors, when the cellular elements greatly preponderate, become very like each other, if not undistinguishable, as far as their mere structure is concerned.

CHAPTER LXVI.

DISEASES AND TUMORS OF THE BREAST.

Sore Nipples are sources of great distress, and too often the precursors of mammary abscess. They are doubtless often caused by some aphthous condition of the skin of the part, but as frequently result from some unusual sensibility of the skin of the part, and at times from want of care. In first pregnancies mothers should always harden their nipples by the daily use of some spirit lotion, or eau de Cologne and water; and where they are not sufficiently prominent a breast glass or gutta-percha shield, such as that

sold by Elam, of Oxford Street, should be worn. Nothing tends more to prevent this troublesome affection than these means.

When they occur at the time of suckling, the same shields should be worn, and great care observed to dry the nipples after use, and never to leave them in the child's mouth after the process has been completed. The application of the glycerin of tannic acid, Richardson's styptic colloid, tincture of catechu, a solution of nitrate of silver, gr. v to the ounce of water, or an ointment of extract of rhatany, gr. viij to ʒij of the oil of theobroma, are good applications. Castor oil as an external application, or collodion, is sometimes useful. When cracks exist, it is a good plan for the mother to draw out the nipple by means of the old-fashioned feeding-bottle before giving it to the infant, the mother's nipple being put into the central opening, and her mouth drawing the artificial one; another ready method is the application to the nipple of the mouth of a wide-necked empty bottle that has been heated by hot water. The nipple, as the bottle cools, is pressed into the bottle and rendered prominent in a painless way.

Engorgement of the Breast takes place in a woman when from any cause she is unable to give suck, either from defect or disease of the nipple or the death of the child. Under these circumstances the gland becomes distended, and if left unrelieved for twenty-four or thirty-six hours will probably become inflamed. When the gland can be relieved by the application of an infant to the nipple, or next best by a bottle in which a partial vacuum has been made by means of hot water, or the mother's mouth, or a very carefully applied breast-pump, the tension may be relieved.

Pressure should then be employed by means of strapping, and this should be applied over the gland, previously smeared with the extract of belladonna, rendered liquid with an equal part of glycerin. A saline or other purge is often of value, with some tonic medicine, as quinine, a mixture of two or three drachms of the sulphate of magnesia and one or two grains of quinine being as good as any.

In lobular engorgement of the breast gentle friction is of great value, with or without oil; warm applications and moisture are most grateful.

Inflammation of the Breast may appear as a *subcutaneous* peri-glandular abscess, more or less extensive; as a *local* phlegmonous lobular inflammation; or *diffused* throughout the whole gland. It may primarily involve the connective tissue which exists between the lobules as well as the true secreting structure of the gland.

It may be *acute* or *chronic* in its nature, and may disappear without any breaking up of tissue or suppuration, or it may be attended with most destructive local results. The extent of destruction of tissue depends upon the severity of the inflammatory process, and the amount of constitutional power of the subject of the disease. As a rule, however, suppuration takes place.

In a general way inflammation attacks the breast gland when in a state of activity; it is exceptional for the passive organ to be the subject of this process. Out of 102 consecutive cases under my observation, 79 occurred during lactation, 2 during pregnancy, 21 in patients who were neither suckling nor pregnant. Three-fourths of the cases that occurred during lactation attacked patients during the first two months. In many of these a cracked nipple was the assigned cause, but I am disposed to think with Mr. Ballard that abscess in the early months is due to the searching of the child after milk before the gland is filled, in patients who have neither sufficient power to secrete nor to resist the inflammatory process when once originated. The affection is more common in primiparae. The right breast is more frequently affected than the left in the proportion of 5 to 3. In

some cases the rapidity of the process is very marked, an abscess forming within a few days; in others, again, it is most insidious. Chronic abscesses in their progress are often mistaken for new growths, and their removal even has been attempted.

Abscesses occur in *infants' breasts*, and they are too commonly the consequence of an ignorant nurse applying pressure to the glands in which milk is often found, or friction to "rub away the milk." The milk appears to be more abundant in the male than the female infant.

They are also met with in the male subject from injury or other causes.

Chronic mammitis, in the boy and girl, is by no means a rare affection, the undeveloped gland becoming indurated and very painful; such cases, however, rarely suppurate.

TREATMENT.—The activity of the treatment of the affection we are now considering must be regulated by the acuteness or severity of the inflammatory process, and the nature of the constitutional and local symptoms to which it may give rise. As a broad truth, however, it may be confidently asserted that the inflammatory process is of a low type and of a destructive nature, and that, as the constitutional powers of the patient are generally feeble, nothing like lowering measures are to be adopted, but on the contrary, soothing local applications and constitutional tonics, with sedatives, are absolutely demanded.

In cases of inflammation of the breast taking place during lactation I have rarely seen an instance in which any other principles of treatment than those I have just laid down could be entertained. The subjects of this affection are mostly feeble, and want of power is the most prominent symptom. Under such conditions, therefore, soothing fomentations to the breast, either of warm water or of some medicated solution, as the decoction of poppies, are the local applications which give the most relief, although a light linseed poultice or some spongiopiline may be well employed. In young, robust women, where suckling is impossible, the application of laxatives and powerful purgatives may be called for.

Rest in the horizontal posture affords striking comfort to the patient, and, when it can be carried out, is of great practical advantage; but if this desideratum cannot be secured, the whole breast must be well supported by a band or linen sling. During this time tonics, in such a form as can be borne and may be indicated, should be freely given, quinine being probably the best. Stimulants, such as wine or beer, should be cautiously administered, but the cases are few which do not require such an addition to their diet; and plenty of good nutritious food should be allowed. A sedative at night is also very generally needed, for want of sleep from pain is a common accompaniment; Dover's powder, in ten-grain doses, is the best form. A mild purgative in the early stages of the disease may be called for, but everything like excessive purgation should be avoided, as the object of the surgeon is to supply power, and not to take it away—to soothe symptoms, and not to irritate.

On Opening a Mammary Abscess.—There is amongst surgeons a great difference of opinion about the propriety of opening a mammary abscess. Some believe it to be the best practice to let the breast alone, and to leave the operation to nature, whilst others advocate the making of an early opening. In neither of these opinions am I disposed to coincide, although I believe it to be a right practice to postpone puncturing the organ as long as possible, and not to show any over-anxiety to evacuate the pus. Still, on the other hand, when the abscess is left to itself, much unnecessary suffering is endured, and a considerable sacrifice of skin often follows, entailing a long convalescence and an ugly cicatrix. The practice I generally

adopt is to leave the parts alone till pointing has taken place, and then to puncture, making my incision in a line radiating from the nipple of the patient. By adopting this practice any unnecessary pain is saved, for the appearance of pointing is directly under the observation of the surgeon, and it is not necessary to make frequent and careful physical examinations. Of course, some gentle manipulation is absolutely called for, to enable the surgeon to form an opinion, but the eye is the chief guide, and not the finger. Much manipulation of the gland is both painful and injurious, but an absolute abandonment of all local surgical treatment can only be condemned.

Warm fomentations are in all stages of the disease very grateful to the patient, and may be freely used; when early suppuration threatens, a light linseed poultice is probably the best application; but when the abscess has discharged, the poultice may be laid aside, and wet lint alone employed, for constant poulticing soddens the integument, and retards the process of convalescence.

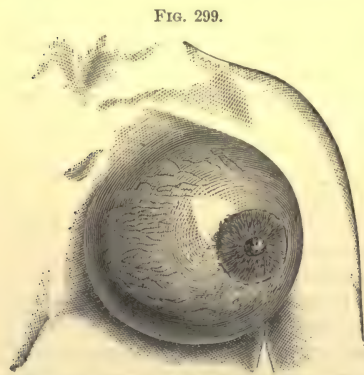
On the Treatment of Chronic Abscess of the Breast.—The existence of a chronic abscess having been made out—a point, by the by, which will be returned to when the subject of the diagnosis of a mammary tumor is discussed—it becomes an important question what treatment should be pursued.

When the abscess is small, and causes little, or no annoyance, it may be left alone, and, under the influence of tonics and local pressure by means of strapping, the fluid may be absorbed; such a result is occasionally brought about. In the majority of examples, however, some more active treatment is required, and in these the evacuation of the pus is the chief point. If the abscess be large and deeply seated—a common condition—the drawing off of its contents by means of a trocar and canula is the usual practice, and it is generally believed to be the best; but it has this disadvantage, that the wound generally soon closes, and a second operation is then required. The same treatment may be again resorted to, with the same results, and this drawing off of the pus and the subsequent closure of the wound may go on for many times. At last, however, the opening remains patent, and the abscess contracts, leaving in the majority of cases a sinus. Under these circumstances a bolder plan of treatment seems absolutely demanded, for time is an important element in the consideration of any plan of treatment, and the best method appears to be a free opening at

the first operation, the surgeon subsequently inserting a strip of oiled lint into the cavity of the abscess for a few hours to prevent the wound closing.

Submammary Abscess.—Abscesses occasionally form *behind* the breast gland, over the pectoral muscle; they push the gland forward in a way that is characteristic (Fig. 299), and, as a rule, point below the breast. They should be opened in the most dependent position as soon as any indication of fluctuation can be made out. This disease is very slow in its progress.

On the Treatment of Sinuses.—The treatment of sinuses in the breast, as elsewhere, is always a task of some difficulty, and in certain cases all plans



Drawing 401st, Guy's Mus., Birkett's case.
Submammary abscess.

will be found to fail; but the one principle of practice which seems to be the

most valuable is the establishment of a dependent outlet, for when this has been secured the upper sinuses, as a rule, heal. To gain this end, the introduction of a drainage tube is a valuable practice, and certainly a simple one. Should there be many sinuses, some pressure may be employed by means of strapping, care being taken that the openings are left uncovered, and that a free passage is left for the discharge. Superficial sinuses may be slit up, if other means fail, and in very chronic cases some irritant, as iodine, may be injected, to excite a fresh action; but the great principle of practice in these cases appears to be the one to which I have already alluded, although others may be at times demanded when this fails.

Chronic induration of the gland occurs when, from some cause or other, the gland is morbidly excited. It is found mostly in unmarried women during the later periods of life, between thirty-eight and forty; but it occurs in the married, and then, as a rule, in the sterile. It is usually associated with some catamenial irregularity, some general disturbance, and more particularly of the nervous system.

The affection is known by the excessive sensibility of the indurated gland on manipulation, the nervous excitement the examination causes, the total absence of any local indications of a tumor, when the fingers are placed flat upon the part, and the induration of the gland, or lobe of the gland, when the organ is raised from the pectoral muscle and pinched.

The *treatment* consists in correcting what is wrong in the general condition of the patient by means of iron, tonics, and alteratives, and soothing the affected part; cold lotions are at times grateful, at others a belladonna plaster affords relief, with or without pressure; large breasts should be suspended, but all should be protected by cotton-wool from the risks of injury.

The irritable mamma of young girls is closely allied to the affection just described; it is associated with a morbidly sensitive condition of the mammary gland, and parts around, and often with some induration; it is an affection closely connected with the pelvic generative organs, which are mostly found to be not acting fairly, as indicated by catamenial irregularity, &c. This condition is, doubtless, at times excited by depraved habits. It is to be treated on the same principle as the last affection.

ON TUMORS OF THE BREAST.

Their Clinical Examination and Diagnosis.—In a practical point of view, tumors of the breast may be divided into the inflammatory, the adenoid or innocent, and the malignant.

Simple hypertrophy, or excess of growth of the gland, can hardly be classed amongst the tumors.

The diagnosis of these tumors will claim our first consideration.

The first point a surgeon has to determine when consulted by a patient who has "something the matter" with her breast, shapes itself in some form or another into the question as to the existence or non-existence of a tumor. That is, is there a new growth developed behind, within, or in connection with, the mammary gland? or is the disease from which the patient is suffering situated in the substance of the glandular structure itself? This first and most important question is one which must needs be solved before a further step can with safety be taken towards the formation of a correct diagnosis of the case, and it is quite impossible to magnify its importance. To do this, however, considerable care is needed, and some manipulative skill is called into requisition; for a careless examination will surely end in an uncertain diagnosis, and with this a failure in treatment must neces-

sarily follow. In examining a breast, therefore, with diagnostic intentions, the surgeon should take the whole gland in his hand; he should manipulate it gently and in every part with his fingers and thumb; and by these means he will, if an isolated tumor is to be found, in all probability detect its presence; if, however, he be uncertain upon this point, he should make the patient lie down, and if a new growth then really exist he will at once discover it. "If a patient be sitting or standing, and the breast is grasped by the finger and thumb, when induration of the gland itself exists, a sensation is felt as if a tumor were present. If, now, the palmar surface of the fingers be pressed flatly against the chest in the same part, nothing remarkable is distinguishable. If a tumor or new growth exists, however, it is immediately perceptible. But if any doubt arise in the matter, the patient should recline when under examination; and then, if there be a tumor, it is immediately manifest to the touch, and often to the eye." (Birkett.) Having, then, detected the presence of a tumor, that is, an independent growth, developed in the neighborhood of the breast-gland, and probably in connection with it, the question arises as to its nature. Is it a simple tumor, or is it a malignant one?

Adenocèles.—If the tumor be movable and hard—if it be quite free, or if it has but a very uncertain connection with the gland structure—there is a strong probability that the tumor is of a simple nature; and, if it has existed for several months, this probability becomes stronger, for it is an early characteristic of the *cancerous* tumor, even when primarily developed as a tuber, or as an independent structure, that it associates itself and becomes connected with the neighboring tissues; and if this has not taken place, the absence of these conditions enhances the probability of the simple nature of the growth under examination. If the patient be also young and healthy, and if no other abnormal conditions, either of the breast or neighboring structures, are to be detected, the probability becomes a certainty, and the presence of an "adenocèle" may be determined on; this tumor being synonymous with the chronic mammary tumor of Sir A. Cooper, mammary glandular tumor of Paget, sero-cystic sarcoma of Brodie, or adenoma of Birkett. These *adenocèles*, as a rule, appear in the young and unmarried; in the comparatively healthy and robust. They appear during the period when the procreative organs, and amongst them the mammary glands, are in a state of "developmental perfection;" and when attacking the married woman, they most frequently are developed during pregnancy or suckling. They are never associated with any other symptoms than such as can be produced mechanically by their presence; they never involve the integument except by distension, and the skin is never infiltrated by any new material. They are never accompanied by any secondary enlargement of the absorbent glands, nor associated with any secondary deposits; they never cause any cachexia nor undermine the health; they affect the patient solely through local influences, and demand treatment chiefly from local considerations.

They are found in either breast, and occasionally in both together. Two or more tumors are also often found in the gland.

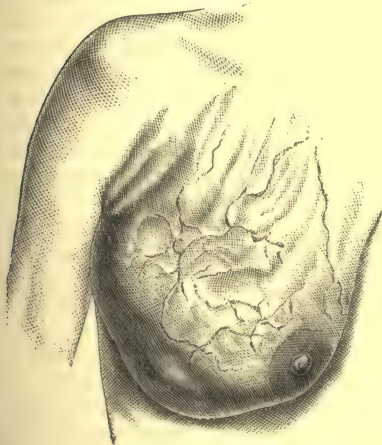
Out of my notes of 81 cases consecutively observed—

22 appeared under the age of 20.	2 above the age of 50.
28 between 21 and 30 years of age.	37 were in single women.
18 " 31 " 40 "	31 in the married and prolific.
11 " 41 " 50 "	12 in the married and sterile.

As local affections, they are, however, at times exceedingly distressing. As long as they remain small and quiescent, they are of little importance;

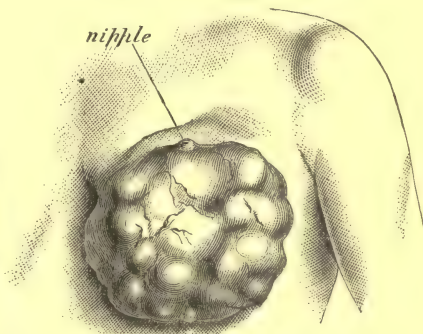
and being movable, and unaccompanied by any other symptom, they are readily diagnosed; but when years have been allowed to pass, and their growth has increased, when from their greater size they become burdensome, and press on neighboring structures, they are neither of small importance nor are they readily to be distinguished. But yet, if careful observations are taken, an error in diagnosis should not be made. For although the breast itself may be much pressed on, or even expanded over the tumor, it will still exist, and on careful examination its presence, as a rule, will be made out. The nipple, although flattened from the extreme glandular expansion, can still be seen (Fig. 301); it is rarely retracted. The integuments may be stretched to an extreme point, yet they will still be movable and sound (Fig. 300), although some inflammation from over-distension may have made its appearance, and large veins are always to be observed meandering in the healthy tissue. The tumor, if solid, may appear lobulated (Fig. 301), and, if containing cysts, fluctuation may be detected.

FIG. 300.



Cystic adenocoele.

FIG. 301.



Solid adenocoele of six years' growth, in A. S., æt. 36.

Still, the disease is essentially a local one, and affects the patient through purely local considerations. It is to be treated only by excision, and the gland should, as a rule, be left unharmed, the tumor being turned out of its capsule; in extreme examples, however, the breast is so stretched out as to be useless, and it has to be removed. In the patient from which Fig. 301 was taken this was the case. She was a woman æt. 36, and the tumor was of six years' growth.

The diagnosis of a tumor which is evidently caused by some partial or general enlargement or infiltration of the mammary gland.—Let us suppose that the surgeon has a case of disease of the breast before him in which the structure of the gland is itself involved; that there is no independent movable tumor, such as we have been considering; but that it is evident on manipulation that the malady, whatever it may be, is intimately connected with the gland structure.

What is the case? Have we an inflammatory affection only of the organ, or have we some simple hypertrophy or innocent enlargement? Is it a simple disease, or is it a malignant one? If the manipular indications of the mammary gland are those only of enlargement, is such a condition due to pregnancy, or is it the product of a simple hypertrophy, confining the meaning of that term to an excess of growth?

If the increase be due to *hypertrophy*, which, by the by, is a somewhat rare condition, this has been to a certainty of a chronic nature, its increase has

FIG. 302.



been slow and its growth painless; it is simply characterized by an increase in size, and beyond that can hardly be regarded as a disease; there is certainly no increase in action beyond that which growth demands. This increase in growth may be very great. I have seen it in the male as in the female, and at times affect only one gland. It is mostly found in young women. In the case from which Fig. 302 was taken, each gland on removal weighed about fourteen pounds. I saw the case some years ago down at Grantham with my friend Mr. Shipman. The breasts were subsequently removed by Sir W. Fergusson.

If the enlargement be due to *pregnancy*, there can be little difficulty in the diagnosis, for it is attended with an activity of the local circulation, a general fulness of the gland, an enlargement of its veins, and a darkening of the areola, which will not fail to excite suspicion. Besides this, *both glands* will be similarly affected, a coincidence which is rarely seen in any morbid condition. The very suspicion of pregnancy, however, will be enough to call attention to other points, by which a solution of the difficulty will be obtained.

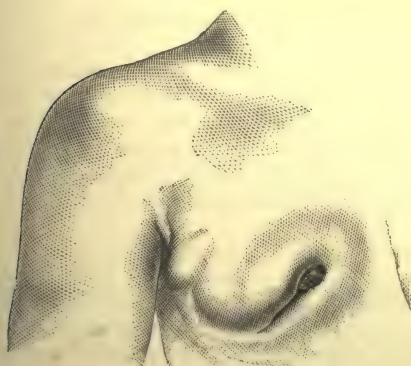
Is the enlargement to be explained by any inflammatory condition? I do not mean an acute inflammatory condition, for such an affection has features which are too characteristic to require any further allusion to it—but is this infiltration of the gland, which is present, to be explained by some chronic inflammatory change, such as is so frequently found in the female breast? In certain patients—that is, in the middle-aged—when cancerous affections are to be looked for, the presence of an indurated mammary gland, whether it be partial or complete, must always be regarded with suspicion, and in certain recent cases I believe it to be an impossibility to form any certain opinion as to its true nature. If the induration of the gland be the only symptom, and this induration be associated with a sharp pain, or even a dull one, either a simple chronic inflammation of the gland may be indicated, or the early condition of a cancer; under such circumstances it is as well to wait before giving any positive opinion. If, however, much time has already passed, say many months, and no other symptoms have made their appearance, there is some good ground for the hope that the enlargement may be due to inflammation, for infiltrating cancers are not generally inactive—as a rule, are not stationary—and soon give rise to other symptoms, such as some, though it may be slight, enlargement of the absorbent glands; to some slight dimpling or drawing in of the skin—an important sign (Fig. 304); or to some more marked symptom, such as infiltration of the integument or a retracted nipple. It is to be remembered, however, that a retracted nipple is only an accidental symptom, such as may be caused by several conditions, and is not by any means of itself characteristic of cancer. But if any one or all of these symptoms show themselves soon after the first appearance of the lobular enlargement of the mammary gland, an opinion as to the cancerous nature of the growth may be confidently expressed. If, on the other hand, none of these symptoms make their appearance, and the induration or infiltration of the lobes of the gland remains

stationary, or shows some tendency towards improvement, the probability of the simple character of the disease gains ground. Should this induration of the mammary gland appear, however, in the *young subject*, there will be no reason to suspect a cancer, and it should rather be regarded as the result of some slight inflammatory effusion. There will, as a rule, be some increase of pain after examination, but there will be an absence of any other local symptom. There will probably be some irregularity of the catamenia and some signs of general excitability of the patient. But as a local affection, there will be only the one symptom of induration of one lobule or more lobules of the mammary gland, which, *in the absence of all other signs*, may with safety be regarded as inflammatory. The same argument holds good when the disease appears at a later period of life, although our suspicions of a cancer should rightly be excited; still, the positive diagnosis must be postponed till, by the lapse of time, some other symptoms, such as those already mentioned, make their appearance, to clear up all doubt, or by their absence prove the innocent nature of the affection.

Carcinoma of the Breast, or Cancer.—This affection is found either as an *infiltration* of the gland wholly or in part, or as an independent tumor or tuber within the meshes of the gland—*tubercular cancer*. It may likewise be met with associated with cysts—*cystic cancer*, this form being only a variety of the other forms.

In the infiltrating form the gland appears hard, inelastic, and incompressible; as it progresses it seems to contract and to draw all the parts around together and gradually to infiltrate them. In this way the nipple often becomes drawn in, or to one side; at times, after having been drawn in, it becomes infiltrated with the disease, and becomes again prominent; at others by the contraction of the gland, it may be strangulated, become œdematous and slough off. The skin becomes at first dimpled, then puckered, and at last infiltrated. The breast, also, from being a movable organ becomes a fixed one; so fixed, indeed, that it cannot be separated from the pectoral muscle.

FIG. 303.



Drawing 409^B, Birkett's case.
Infiltrating cancer and retracted nipple.

FIG. 304.



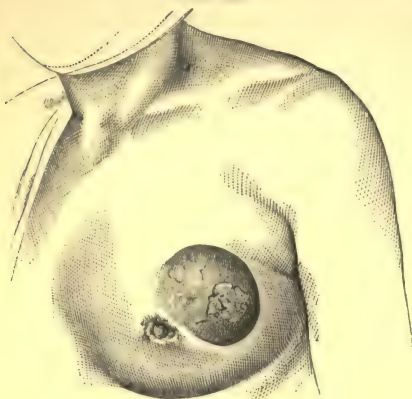
From model.

This form of cancer is the more common one. The disease may appear in one lobe or in all; it may be slow in its progress or rapid, but in every case its progress is much alike; at times, however, this infiltrating form of cancer assumes the characters of the tubercular. In Figs. 303-4 these changes are well shown.

The *tubercular* cancer commences as a circumscribed independent growth

within the gland structure, with a well-defined capsule separating the tissues but not infiltrating them. At times two or more tubers appear together, and these may at last coalesce. This form, unlike the infiltrating, does not

FIG. 305.



Tuberos cancer.

contract, but grows in all directions, involving all the parts which it touches, pushing the breast to one side, or drawing it to itself (Fig. 305): it often attains a large size, giving rise to an irregular lobulated tumor. It is at times soft in consistence, when it is called *medullary cancer*; when firm, it is known as *fibrous*; when jelly-like *gelatiniform*; more rarely it is black or *melanotic*. As it grows forward it may involve the skin, break and ulcerate, giving rise to the appearances formerly called *fungus hæmatodes*, this form of cancer being always accompanied with hemorrhage.

In both forms the lymphatic glands in the axilla, above the clavicle, or on the side of the neck, will sooner or later become involved; and when the skin is implicated, this symptom soon appears. As the glands enlarge, nerve pains appear down the arm, and œdema of the arm commences from the mechanical obstruction to the venous circulation of the extremity caused by the enlarged glands; at times a serous effusion takes place into the pleural cavity of the affected side sufficient to destroy life.

In some rare cases of cancer the disease appears as a *brawny* infiltration of the breast and integument over it, some erythematous redness and œdema being mixed with it at its onset. These cancers are of the worst kind, and speedily destroy life.

In other cases, mostly chronic, the disease is more cutaneous, and shows itself as a tubercular affection of the skin, which gradually spreads, till at last the part affected seems skinbound. This condition may be limited or extensive; at times it involves the whole of one side. I have recently had a case under observation, in which both breasts, the sternum, sides, and half the dorsal region of the back were thus involved: at times this tubercular development is associated with acute or recurrent disease; in rare examples it occurs as a primary affection, and is very chronic, the tubercles even disappearing by atrophy.

A *cancerous tumor* of the breast most frequently appears in middle life, that is, when the procreative organs are verging towards their natural period of functional decline, such a period taking place at an earlier date in the single than in the fruitful woman. It attacks married women more frequently than the unmarried, and, when infiltrating or involving the breast-gland, is seldom stationary.

As the disease progresses unchecked, ulceration of the integument, preceded by a softening down or breaking up of the tumor itself, will soon appear, and with this the characteristic infiltration of the margin of the wound, with its indurated, everted edges. A general cachexia, from the pain and wasting discharges, will soon show itself, and more or less distinct evidences of the complication of other organs will become apparent; and under such circumstances the end is not far off. The disease has run its course, and with it the powers of its victim have been undermined, victory remaining

with the strongest. In a general way a cancer runs its course in two or three years; at times, however, it is most chronic in its action.

To illustrate some of the points connected with this subject the following analysis of 400 cases may be of value. They are taken from my own notes; 180 occurred in Guy's during the period of my registrarship many years ago, and 220 are from my own case-book since.

The disease made its first appearance—

In 17 cases, or 4 per cent., under 30 years of age.									
" 108	"	"	"	27 per cent.	"	between 31	"	and 40	years of age.
" 144	"	"	"	36	"	"	41	"	50
" 101	"	"	"	25	"	"	51	"	60
" 29	"	"	"	7	"	"	61	"	70
"				1					over 70 years of age.

I have never seen a case of cancer of the breast in a patient under 20. But I have seen one of a year's standing in the breast of an old lady æt. 96. 313 of these patients were married, 77 single, and 10 widows.

Of the 313 married, 235 were prolific and 78 sterile; and a large proportion of the prolific women were so to an extreme degree, ten and more children being a common note to find recorded. Married women, and those in whom the gland has been the most active, are apparently more liable to cancer of the breast than the single when the period of gland activity has passed.

194 of these examples were in the right breast, 187 in the left, and 19 in both.

In 140 the disease had existed a year or less.

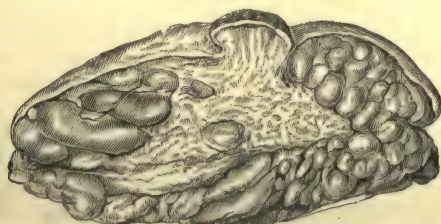
In 99 between 1 and 2 years.									
" 23	"	2	"	3	"	In 13 between 4 and 5 years.			
" 15	"	3	"	4	"	" 9	"	5	" 7
						" 6	"	8	" 9

In four cases the disease had existed ten, twelve, fourteen, and twenty years respectively. The form of cancer in those of long standing is generally the atrophic.

With respect to any *hereditary history* of cancer in the 400 cases, although carefully inquired into, it existed in only 47 cases, or nearly 12 per cent.; in 35 cases cancer was reported to have occurred in one member, in 11 in two members, and in one in three.

In 7 of the 47 cases the relative was on the father's side, in 23 on the mother's. In 7 it was found amongst the brothers or sisters, in 5 amongst the aunts, in 3 cousins, and in 1 grandmother. In these the point was not stated respecting the paternal or maternal relation. But these facts are enough to indicate that where an hereditary tendency exists, it is more powerful on the mother's side than the father's.

FIG. 306.



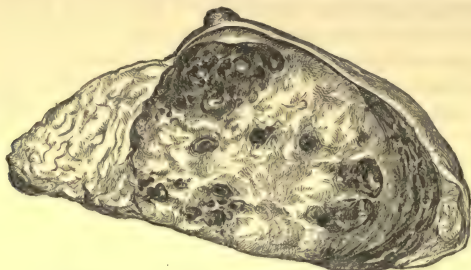
Drawing 409¹⁸, Guy's Mus., Birkett's case.

In a large proportion of the cases in which an hereditary history of cancer was traced, the cancer was of the breast.

A section of an infiltrating cancer is well shown in Fig. 306. A section

of the tuberos form in Fig. 307. For the microscopical appearances of cancer *vide* Fig. 297.

FIG. 307.



A section of a tuberos cancer. Birkett's case.

Colloid or Alveolar Cancer is occasionally seen in the mamma, although in a clinical point of view the growth presents no such features as to enable the surgeon to recognize its presence. It is found in the gland as an infiltrating and tuberos growth.

To the eye the colloid disease has a peculiar aspect, its jelly-like semi-transparent material, of all tints of pink and red from degrees of blood-staining, being divided by thin meshes of fibre-tissue into cells of different sizes. The way the jelly-like structure oozes from its cells, and the slight changes that take place in it after immersion in spirit, are its chief characteristics.

It is to be treated by excision of the whole gland.

Cystic Tumor of the Breast.—The simple sero-cyst is usually found single in the mammary gland, and appears as a small hard lump in one spot: at times this is painful, but often not; as it increases it becomes more globular and feels very dense, sometimes of a stony hardness; at a still later date it may afford the sensation of fluctuation; if left alone it may so enlarge as to come forward and even burst, discharging a thin watery non-albuminous fluid and then collapsing. In rare cases the disease is then cured; more commonly, however, the fluid reaccumulates.

The cyst-wall of this tumor, writes Birkett, is very thin, composed of fibre-tissue, firmly attached to the surrounding parts, and lined with squamous epithelium; it is always perfectly closed, and never communicates with a duct.

Such a cyst is to be punctured with a trocar and canula, and some cold lotion applied; by this means many are permanently cured. Brodie employed alone, without puncture, a lotion made up of an ounce of the solution of the subacetate of lead and three ounces and a half of both spirits of wine and camphor; this is to be applied on a piece of folded flannel, and renewed every three or four hours, until the skin over the tumor becomes inflamed; the application to be reapplied after the lapse of two or three days.

Besides the simple serous cyst, many examples of tumors of the breast come under the observation of the surgeon, the diagnosis of which is much obscured by the presence of cysts, or rather what Mr. Birkett describes as capsules, containing fluid of divers characters. The development of a cyst in the majority of tumors is a mere accident; it is not a new development, such as the more solid portion of a tumor, nor is it in any way to be compared with the simple cystic formations which are found in the neck or other portions of the body; it is to be looked upon as a collection of fluid, prob-

ably serum, more or less bloodstained; it is by the gradual accumulation of this fluid that the more solid growths are separated, and an apparent cyst is formed. But this cyst is only spurious, it has no special structure; its artificial walls are made up of condensed cellular tissue. The existence, therefore, of these false cysts, in any of the breast tumors, whether adenoid or malignant, such as I have briefly sketched, is to be regarded as a mere accident. The presence, therefore, of cysts in a mammary tumor has no weight in determining either the innocency or the malignant nature of the growth under examination; they are the product of a mechanical cause, and may consequently occur in either form; they are not special growths, nor are they of any intrinsic importance. The diagnosis of the tumor

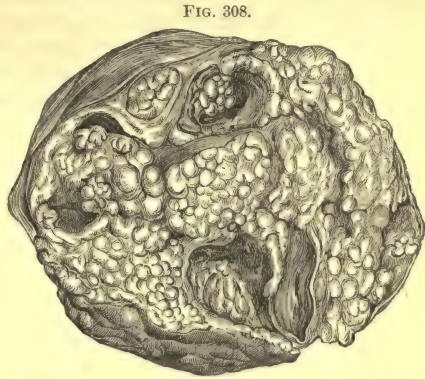


FIG. 308.
Section of adenocoele, with cystic and intracystic growths of all kinds.

containing such cysts rests on other points, and more particularly on such as have been already indicated. As a rule, however, these so-called cysts are found in the less firm and solid forms of tumor, in those that contain less cellular or connective tissue, and in the more rapidly developed rather than in the slowly formed. In one form of cystic adenoma the tumor will be more or less solid, and in the parts in which the false cysts or capsules exist the growth will be more lobulated and loosely connected. In a *second* class of cases loose pedunculated growths will, in some instances, be seen lying within these capsules, their floating extremities being bathed with the so-called cyst contents (Fig. 308). The different forms assumed by these tumors depend upon the amount of connective tissue which binds together the several lobes and lobules, and the dimensions of the interspaces which go to form the false cysts. In a *third* class the adenoid solid elements are developed within cysts composed of dilated ducts,—the true cystic adenocoele of the breast. In all the elementary structure of the growths, whether these be dense and compact, loose and pedunculated, within false cysts or in dilated ducts, simulates the structure of normal gland tissue; in some the caecal terminations of the ducts are the most prominent, in others the ducts and sinuses, and, in a few, true milk or cream secretion exists, precisely similar to that secreted by the breast. In Fig. 308 every variety of this affection can be seen. In all probability, however, all adenomas are developed in cysts as intracystic growths. Dr. Goodhart in an able paper has supported this view (*"Edin. Med. Journ.,"* 1872).

Cystic Cancer.—When cysts are present in the *malignant tumor* they are produced in precisely the same way as in the innocent; but as the formation of the former differs from that of the latter, the cystic contents will vary also, the false cysts in the one instance containing the more or less solid characteristic lobules of the adenoid growth, whilst in the other case they are filled with the less developed and more irregular, but equally characteristic, material which goes to build up the cancerous tumor.

On the Diagnosis of the "True Cystic Adenocoele" of the Breast.—The remarks which have just been made respecting the importance of cysts in the innocent and malignant tumors of the breast are not applicable to all cases; for to this rule, as to others, there is an exception, and in the present

case the exception is to be found in that form of cystic disease of the mammary gland which is essentially a cystic disease of the gland itself, more particularly connected with its secreting ducts, differing from the other forms of cystic adenocoele, which are new growths, and are developed independently of, although allied in structure to, the breast-gland itself. This true cystic adenocoele, however, is of an innocent nature, and pathologically is allied to the genuine adenocoele; it is the tumor originally described by Sir B. Brodie as "arising by a dilatation of portions of some of the lactiferous tubes," and by Mr. Birkett as duct-cysts distinctly referable to the dilatation of a duct, or to a connection with one, and containing growths which appear to spring from their walls. These two forms of cystic adenocoele are strictly analogous in their nature. In both the pedunculated or floating bodies possess a structure allied to the breast-tissue, and composed of more or less distinct caecal terminations of newly developed ducts, with variable quantities of true connective tissue. This affection is more common in middle than in young life. Out of 14 cases, 3 only occurred in women under 30; in 11 it was found in women over 40, and in one patient as old as 71 ("Path. Trans.," vol. xvii, p. 283).

How, then, is such a tumor to be made out? and what are the special symptoms which characterize it from the other forms of mammary tumor?

First of all, it is to be looked upon as an innocent tumor, and, consequently, it will be found to affect the patient precisely in the same way as all other adenoid tumors, in a purely local manner. It is to be regarded as a local disease, which at no period of its growth and in no way affects the patient otherwise than through local causes; it is never associated with secondary glandular enlargements or with secondary deposits in other tissues, as in the cancerous tumor, and we must therefore look to local symptoms to guide us in the formation of a correct diagnosis.

It is to be remembered that it is a *genuine cystic disease*. The tumor is always made up of cysts, possessing solid contents in different degrees; but the existence of cysts is uniform and characteristic; *it is also a disease of the gland itself*. Unlike the other forms of adenocoele—whether cystic or solid, which are new growths, developed and growing independently of the mammary gland, although in some instances having a slight connection with it—it is a true cystic adenoid disease of the mammary gland itself, and mainly of its ducts; it has, therefore, in the majority, if not in all cases, some communication through the nipple with the external surface, pressure enabling the surgeon to evacuate some of the contents of the cyst through the nipple of the affected organ. As a result, this symptom, when present, must always materially tend to confirm the impressions which may have been formed by the careful observation of the case, and by the presence of those conditions to which attention has just been drawn.

A *cystic tumor of the breast-gland*, in a healthy woman, unattended by any other than local symptoms, and accompanied with the discharge of a clear or colored viscid secretion from the nipple, which can be induced or materially increased by pressure, may with considerable confidence be set down as the form of disease we are now considering, and may with justice be described as the *true cystic adenocoele* of the mammary gland, in contradistinction to the false adenocoeles or other tumors, which have but little, if any, connection with the true gland-tissue, but which are new growths partaking of the nature of the breast-gland, according to the pathological law, which appears universal, that all new growths partake of the nature and peculiarities of the structure in which they are developed.

Galactocoele is a milk tumor found in a breast during lactation, and is the result of some retention of milk in an obstructed or ruptured duct, the

secretion being either fluid and milk-like, or more solid and creamy, owing to the absorption of the more fluid elements. Prep. 2290⁵⁰, 2290⁵⁰, and 2299⁴⁰, Guy's Museum, illustrate these points. It occurs usually somewhat suddenly during suckling, and is indicated by a painless fluctuating swelling, unaccompanied with any constitutional disturbance; at times these cysts attain a large size. Scarpa has recorded a case from which two pints of milk were evacuated. This affection is to be treated by an incision into the cyst, leaving the walls of the cavity to granulate.

Adenomas or adenocoeles, cystic or otherwise, are not, however, the only innocent tumors of the breast, for the *fibro-plastic* and *fibro-cellular* are occasionally met with; such tumors are generally more rapid in their growth, more succulent and less solid than the adenomas, and have a tendency to return after removal. I removed such a tumor, which weighed nearly five pounds, from the breast of a woman, æt. 34, in 1868. ("Path. Trans.," vol. xix.) These tumors, unlike the adenomas, become closely connected with the breast itself, although, unlike the cancers, they do not infiltrate it. They run their course more rapidly than the adenomas, and have a tendency to break down, giving rise to a bleeding mass of tissue which may be mistaken for a cancer. These tumors are, however, local, and are rarely associated with any secondary glandular enlargement. They are to be dealt with as adenomas, and removed.

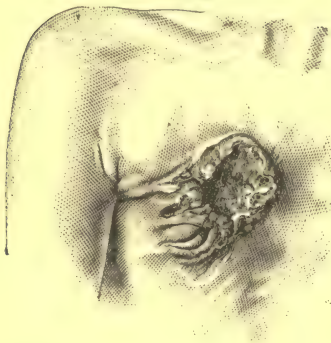
Hydatid cysts are found in the breasts, but they are not common. One example only has fallen into my hands, although I have seen two others in the practice of my colleagues. My own patient was a woman, æt. 30, who for five years had a *painless globular swelling* in her left breast. When I saw her it was as large as a cocoanut. I tapped the cyst and evacuated sixteen ounces of a clear non-albuminous fluid, and as it was evidently the fluid of a hydatid, I made a free incision into the tumor and turned out a large acephalocyst; a good recovery following.

Nævus, involving the whole mammary gland, may be met with. I have had under care a splendid example in a girl, six years old, in which the whole organ was like a sponge and as large as half an orange.

On the Open, Ulcerating, and Discharging Tumor of the Breast.—There may be a period in the growth of any tumor situated in the mammary gland, or in its neighborhood, when the integuments become so involved as to ulcerate or give way, or when a discharging surface or cavity exists which presents an aspect differing according to the innocency or malignancy of the growth with which it is connected. In the *cancerous tumor* it is almost needless to add that the open surface or discharging orifice will be distinctly cancerous; the integument itself or the margins of the wound will be found infiltrated with the cancerous material, presenting the thickened, indurated, and everted margin so characteristic of the cancerous ulcer, and which, when once seen and appreciated, can hardly be mistaken. Not so, however, with the innocent tumors, which are also liable to be connected at some period of their growth with an open wound and discharging cavity, for in these cases a very different condition presents itself to our observation; and to understand this difference it is essential to recall one or two points of difference which have already been mentioned in the nature of the innocent and malignant tumors. It has been stated that it is the peculiar nature of the innocent tumor to affect the part in which it is developed simply in a mechanical way; it may separate or displace tissues, but it never infiltrates them.* On the other hand, it has been stated that it is the peculiar nature of all cancerous or malignant tumors to infiltrate and involve every tissue with which they come in contact. Applying, therefore, these two opposite features of the innocent and

malignant tumors to those cases of both diseases in which the integument is materially involved, we shall readily understand how two very different local appearances will be produced; and how in the cancerous, as just explained, the wound or surface will be characterized by all the peculiarities of the cancerous ulcer, whilst in the innocent tumor the integument will have given way purely from over-distension, and, as a consequence, the margin of the wound or discharging cavity will look healthy, free from all appearance of infiltration, and rather as if cut or punched out mechanically than ulcerated. This great difference between the two affections is most important and is very palpable, and often enables the surgeon to

FIG. 309.



Model, Guy's Mus. Open cancer of breast with infiltration of skin.

FIG. 310.



Intracystic growth protruding through skin in case of simple cystic disease.

form a correct diagnosis in a case where otherwise a difficulty might be experienced. In the *cystic adenocoeles* this healthiness of the margin of the wound is very marked, for it is not uncommon to find a sprouting and discharging intracystic growth protruding from the wound through the ruptured integument, and presenting a very doubtful and sometimes cancerous aspect; but if found projecting through an orifice of the integument which is uninfiltrated and apparently healthy, such as we have already described, the innocent nature of the tumor may with some confidence be declared (Fig. 310).

On the Value of the Retracted Nipple as a Symptom in Tumors of the Breast.—There can be but little doubt that the importance of the retracted nipple as a positive indication of cancerous disease has been considerably overrated. It may coexist with cancer in the breast, as it may with some simple or innocent affection; and a cancer of the organ may be present unconnected with any such morbid condition. For a retracted nipple may be described as an accidental symptom in the development of a tumor; it is the product of mechanical causes, and its presence is determined by the manner in which the gland is involved in the disease rather than by the nature of the affection itself. Should any tumor, simple or malignant—should any abscess, chronic or acute—attack the centre of the mammary gland, a retracted nipple, in all probability, will be produced; for as the disease so placed will necessarily cause material separation of the gland ducts, their extremities—terminating in the nipple—must be drawn upon, and, as a consequence, a retracted nipple will follow. In the

early stage of an infiltrating cancer of the organ this symptom is one of frequent occurrence, the nipple being always drawn towards the side of the gland which may be involved; at a later stage, however, of the affection, when the infiltration is more complete, the nipple may again project. In a central chronic abscess of the breast the retracted nipple is equally common, and in the true cystic adenocoele it may be also present. In the ordinary adenocoele, whether cystic or otherwise, it is rarely present, for the plain reason that this disease is not of the breast-gland itself, but only situated in its neighborhood. In rare cases, however, such an association may exist; in one case only have I ever observed it, and in that some blow or injury had preceded the development of the adenoid tumor, and it is open to doubt whether the retracted nipple might not have been brought on by some chronic inflammatory condition.

On the Value of a Discharge from the Nipple for Diagnostic Purposes.—

It is very questionable whether this symptom has really any material value for diagnostic purposes; and when the discharge is slight or of a bloody nature, it certainly does not indicate any special affection. It is well known that in *cancerous* affections a discharge from the nipple is not infrequent, the fluid having the appearance of blood-colored serum, but it is never profuse, there being rarely more than a few drops. In the *ordinary adenocoeles* this symptom is seldom present. In the *true cystic adenocoeles* this symptom appears to be of considerable value, for in all the cases which have passed under my observation, and in the majority of the recorded examples, this discharge from the nipple was a prominent symptom, the fluid being generally of a mucoid nature, and more or less bloodstained; and although at times it occurred spontaneously, and with relief to the patient, at others it could readily be induced by some slight pressure upon the parts. It exists thus as a symptom in the true disease of the breast structure, whether cancerous or adenoid; it is but slight and uncertain in the former, and more general and copious in the latter; as a means of diagnosis it may become, therefore, of some value.

On the Importance of Enlargement of the Absorbent Glands as a Diagnostic Symptom.—When these are present with a tumor of the breast, they bear important testimony to the malignant nature of the disease; for in all the simple adenocoeles no such complication exists, although in the inflammatory affections of the organ they may be produced. Still, in cases of cancer of the breast many months may pass away without the appearance of these enlarged glands; when they are present they are of positive value, and point towards the malignant rather than the innocent nature of the disease.

On the Value of the Tubercular and General Infiltration of the Integument over the Breast.—If there be one symptom which affords more positive evidence than another of the cancerous nature of any tumor in the breast, it is the one we are now considering, for no such symptom is ever present in any inflammatory or simple disease of the mammary gland. It is a genuine tubercular or general infiltration of the integument with the cancerous product, and, as such, is of special value. It may be slight, from the mere shot or pea-like affection of the skin, to its more general infiltration; but in all stages it is equally characteristic, and speaks in positive language of the cancerous nature of the mammary growth, one tubercle telling as plain a tale as if many tubercles existed.

Cachexia.—I have no belief in the existence of a special cancerous cachexia. A cachexia may be present in cancer, as in any exhausting and wasting disease; but that of cancer differs in no single point from that of any other affection. When a cachexia exists it indicates the presence of

some affection which is undermining the patient's strength; it may be cancer, but it may be any other form of disease.

On Excision of the Breast.—There is no great danger attending excision of the breast, beyond that which accompanies any, even the smallest, operation. It is true that patients occasionally sink after having passed through the operation, from pyæmia, erysipelas, or other causes, contingencies which attend any practice, but from the excision itself there is little danger to life. Of my notes of 133 cases of cancer in which excision was carried out, nine cases died, or about 6.7 per cent., death taking place from the following causes: in three only, or 2.2 per cent., could the death be put down to the operation. One died from pyæmia, on the thirty-fifth day; one from erysipelas, contracted several months after the operation, when the wound had healed; two from acute bronchitis, three weeks and a month respectively after the excision; one from profuse diarrhœa, on the eighth day, probably pyæmic; one from hæmoptysis, in the third week; two from exhaustion after a return of the growth, in three and six months; and one from actual sinking after the operation, on the third day. The three cases which died from pyæmia and from diarrhœa, which was also probably pyæmic, and the one which sank on the third day, may, perhaps, with justice be directly assigned to the operation, but the fatal termination in the remaining six examples had no reference whatever to the excision. In the operations for innocent tumors of the breast no fatal instance occurred. In operating for cancer it is unquestionably the wisest course as a rule to excise the whole gland; when the tumor is, however, very local the rule may be broken through, and it is as well not to be over-anxious about preserving too much integument, for if any doubt exists as to its perfect healthiness, the suspected portion had better be excised. When enlarged glands exist it is wise to take them away. It is always important, when dissecting out the tumor, to keep clear of all diseased tissues, and in fat subjects to leave a fair covering between the incision and the tumor itself, for there is good reason to believe that an early return of the affection is too often to be explained by want of attention to the practice to which I have just alluded. In several instances I have found small cancerous nodules in the fascia over the pectoral muscle, which if left would have been the centre of new growths. In the operation for *adenocèle*, it is quite exceptional for the removal of the breast to be necessary, and in the majority of instances such a practice would be clearly unjustifiable. As a rule, the tumor is readily removed on making a clean section through its cyst-wall and enucleating the growth; the breast is rarely injured, even by the operation. In exceptional examples, however, of this affection, it is absolutely necessary that the breast-gland should be excised, that is, where a large tumor is closely connected with it; and in the genuine or true cystic *adenocèle* of the mammary gland. In the removal of a small tumor not involving the breast the best practice is to make the incision in a line radiating from the nipple, and to manipulate the parts as little as possible; the surest plan being to cut well into the tumor, having previously raised and made it prominent by grasping its base with the thumb and finger of the opposite hand. In the complete removal of a breast the patient should be placed on her back, with the shoulder of the affected side well raised by a pillow, and the arm drawn out at a right angle to the body. The incision should be made in a line parallel with the fibres of the pectoral muscle, and when the skin is diseased the whole should be removed. The inner or sternal incision is the one I usually prefer to make first. All bleeding is readily controlled by the pressure of the fingers of an assistant. The other incision should then be made, the surgeon at once dissecting down

to the free border of the pectoral muscle, the definite form of which is the best and surest guide to the base of the gland. The whole tumor by these means is then readily excised, a few touches of the scalpel dissecting it off the pectoral muscle. The axillary angle of the tumor should be divided last, as it usually contains the chief vessels that supply the gland. All bleeding vessels should be twisted and the surface of the wound cleaned, its edges adjusted as well as possible, and steady pressure applied by means of pads of lint or cotton-wool. *Adenoid* or innocent tumors should be excised only when they are steadily increasing, and are sources of trouble. *Cancerous* tumors should be removed as soon as the diagnosis of their existence is clear, for accumulated evidence tends to show that the earlier a cancer is removed the better the prospects of a complete or lengthened immunity from the disease, and that whether the disease returns soon or late, the best chance is thus afforded to the patient.

CHAPTER LXVII.

DISEASES OF THE THYROID GLAND.

THE thyroid is a ductless, but highly vascular, gland; it has as large a vascular supply as any gland in the body, and it is supposed to have some connection with blood formation. It is also freely supplied with lymphatics. It is a lobulated encapsuled gland with a cellular structure, the cells containing a glairy fluid. When the gland is simply enlarged it is said to be hypertrophied, or the seat of *goitre* or *bronchocele* (*simple adenoid enlargement*), and it is well known that these goitres attain a large size. Sometimes they are apparently composed of simple increase of tissue, the enlarged gland having much the same appearance on section as the small and healthy one; at other times the structure of the tumor is coarser, more cellular, or cystic (*cystic enlargement*), the cysts occasionally assuming large dimensions; while in a third class the gland is more solid and fibrous, or more or less mixed with cysts (*fibrous or fibrocystic disease*). The thyroid gland may inflame, and even suppurate; it may be the seat of distinct adenoid tumors, or of cancer. Hydatid cysts have also been enucleated from its body (*vide* Prep., Guy's Hosp. Mus., 1711⁶⁰).

Goitre, or Derbyshire neck, as it is more commonly known in this country, is very frequently met with; in its most usual form it appears as a simple hypertrophy of the thyroid gland, and gives rise to symptoms which are attributable to the size of the tumor; when of moderate dimensions it may not be inconvenient, when large it may be so, and yet produce no symptoms worthy of special notice. At times, small tumors cause symptoms, such as dyspnoea, or the cough as of a broken-winded horse on exertion, and even difficulty in breathing on the slightest cause. At other times they mechanically press upon the large vessels and respiratory tract, and produce headache and a feeling of fulness in the head on stooping or coughing, with evident respiratory obstruction, and even difficulty in deglutition. These symptoms may also appear for a time and then disappear, leaving the patient comfortable in all respects during the intervals. In other cases, goitres which appear to be of the simple kind, under excitement, or other unknown cause, begin to pulsate, and are attended with some protrusion of the eyeballs; these symptoms disappearing by rest and

time; the case subsequently reassuming the clinical features of a simple goitre.

Such cases as these stand as a kind of link between the simple goitre and that known as the *exophthalmic* goitre, Graves's, or Basedow's disease; and yet between these two affections there must be some wide difference, for the

FIG. 311.



Exophthalmic goitre. Wilks's case.

simple goitre appears to be a local affection, whereas the exophthalmic form is probably part of a more general disease marked by the enlargement of the thyroid body, often prominence of the eyeballs, always palpitation of the heart, a peculiar thrill in the bloodvessels, and a general want of muscular and brain power (Fig. 311). Modern notions tend to indicate that this form of goitre is a neurosis of the cervical sympathetic. "The numerous functional disorders which occur in Graves's disease are either due to temporary congestion of the sympathetic nerve, or a permanent structural alteration of the ganglionic

nervous system." (Trousseau's "Clin. Med.") This view, however, of the affection is not yet proved; the whole subject requires investigation.

TREATMENT.—Simple goitres are to be treated on ordinary principles, by attention to the general health, the inhalation of fresh air, and by tonic medicines. Filtered or distilled water should always be taken, more particularly in districts where chalk, lime, and magnesia abound; for in Derbyshire and the Tyrol districts it is generally believed that it is from the water that the disease is produced. Iodine has always been held in high repute in this affection, originally as burnt sponge, and recently in the form of the iodide of potassium, and in four or five-grain doses, given with bark or quinine, it is of use. For some years, however, I have given tonics alone by the mouth, and have ordered the air of the room to be kept iodized by means of solid iodine, put into a box with a perforated lid, the metal evaporating steadily into the room where the patient sits and sleeps, and in this way becoming absorbed. Under its influence I have often been surprised to find how rapidly goitres disappear. With this treatment I at times rub in an ointment of the iodide of ammonium, a drachm to an ounce. To paint a goitre with the tincture is useless, as one application renders the skin hard and incapable of absorption. Dr. Lücke, of Berne, is in the habit of treating hard goitres by injecting strong tincture of iodine into the tumor, one or more punctures being made at a time, according to the size of the tumor. He reports good success. ("Lancet," 1859.) Dr. Mouat, of Bengal, spoke ("Ind. Annals of Med. Science," 1857) very highly in favor of the use of biniodide of mercury, in combination with the rays of the sun, for the cure of goitre. He used the mercury as an ointment, of the strength of three drachms to a pound of lard. It was to be rubbed in for ten minutes, an hour after sunrise, and the patient was afterwards to sit with his goitre held well up to the sun, as long as he could endure it; after this a fresh layer of ointment was to be applied with a careful and tender hand, and the patient sent home, the ointment being left to be absorbed. In ordinary cases this treatment was said to have been enough to effect a cure, it being only in exceptional cases that a fresh application was called for. He gives his cases of recovery in thousands. It is possible that in this

country the treatment has failed for want of the rays of the sun. I have tried it without the slightest good.

In Graves's disease iodine appears to be of no use; indeed, it is injurious. Tonics, more particularly iron, are apparently the most applicable.

In exceptional cases a goitre may so increase and press upon the larynx and surrounding parts as to threaten life. It may cause death by a gradual process of suffocation, but more commonly by exciting some sudden laryngeal spasm. In 1869 I treated such a case, sent to me by Mr. Holman, of East Hothley, in which a large thyroid gland was causing chronic suffocation by its mechanical pressure, and it ultimately produced immediate death by exciting some laryngeal spasm. Dr. Herbert Davies has recorded a similar case ("Path. Soc. Trans.," 1849), and in the Museums of St. George's and Bartholomew's Hospitals other preparations exist with similar histories.

In some cases the treatment by setons has been of value, suppuration of the thyroid having been followed by a rapid subsidence of the hypertrophied or fibrous structure of the gland. Mr. Hey, of Leeds, adopted this practice with much success. In such examples of goitre the question of operative interference may have to be entertained; it will be considered in another page.

Cystic Bronchocele.—*Cysts* are often met with in this gland, and at times they assume large dimensions. They appear as more or less globular, tense, fluctuating tumors, moving up and down with the larynx, as all thyroid tumors do. They may contain only the glairy fluid of the gland, or a more serous or sanguineous fluid, or old grumous blood. Occasionally these cysts, on being punctured, will go on bleeding even to the death of the patient. Such cysts appear either in one or other lobe or in the isthmus. About a year ago I treated, with Dr. Hess, a case of blood-cyst of the isthmus in a girl, and drew off about half an ounce of a thick, grumous, coffee-looking fluid. In 1863 I tapped a cyst the size of a cocoanut in the right lobe of the thyroid of a woman *æt.* 26, which bled profusely, and the hemorrhage was only arrested on closing the wound. The cyst filled up at once nearly to its former size, but subsequently gradually contracted, and five or six years later hardly any remains of it could be found. Simply tapping a serous cyst may cure it. When it fails, the cyst may be injected with a solution of iodine, varying in strength from five to ten minims of the compound tincture to a drachm of water. When these means fail, a seton has been recommended; it is, however, a dangerous practice, and should only be adopted when simpler means fail and interference is requisite. In cysts of the isthmus, more particularly blood-cysts, an incision into the cavity is a good and successful operation. Should a cyst after tapping suppurate, it must be dealt with as an abscess, and opened freely as soon as the existence of pus can be made out, for the thyroid is in a dangerous position for suppuration to appear. I have successfully treated one case of suppurating thyroid cyst after tapping by incision, but these cases are rare.

Dr. M. MacKenzie has recently ("Lancet," May, 1872) ably advocated the practice of converting the cystic disease of the thyroid into a chronic abscess by the following means: "First empty the cyst. When practicable, it is well to make the puncture as near as possible to the median line, and to select the most dependent portion of the tumor for the introduction of the instrument. As soon as the trocar is felt to pierce the cyst-wall it should be withdrawn, and the canula passed further in by means of a blunt-pointed key. The fluid having been withdrawn through the canula,

a solution of the perchloride of iron (two drachms of the salt to an ounce of water) is injected through the canula by means of a syringe. The plug is re-inserted, and the canula secured in position by a strip of plaster. The injection of iron is repeated at intervals of two or three days, until suppuration is established. When this point is reached the tube is withdrawn, poultices are applied, and the case treated as a chronic abscess. Where the tumor consists of more than one cyst, it may be necessary to make a second or third puncture; but it frequently happens that other cysts can be opened through the cyst originally punctured." Some cysts become calcareous; such are to be treated by excision. This practice is only, however, to be entertained when the cyst is causing symptoms which threaten life. In the Guy's Hos. Museum there is a preparation of a calcareous cyst with an intracystic growth.

Acute inflammation of the thyroid gland is doubtless a rare affection. I have never seen such a case. Holmes Coote records one in "Holmes's System." Suppuration of a cyst in the gland after surgical interference is more common.

Acute hypertrophy may appear, and produce dangerous, if not fatal symptoms. Dr. Risdon Bennett, in his interesting "Lumleian Lectures for 1871," has recorded such an instance, which I had the benefit of seeing, in consultation with him and Mr. Jackson, of Highbury. It was in a young man, æt. 19, who, three months before, became the subject of paroxysmal attacks of asthmatic dyspnoea, associated at times with a wheezing or whistling respiration, and some general enlargement of the base of the neck. Three days before his death this difficulty became extreme, the paroxysms became more frequent and more severe, and on the day of his death a severe paroxysm took place, which passed on to a forced and heaving respiration, beyond anything I had ever before witnessed, and speedy death resulted. I performed tracheotomy upon the patient, with the slender hope that some light might be thrown upon its nature to guide us in its treatment, if not to give relief, but in doing so, what was probable before became evident, that the obstruction was below, and I had no perforated instrument with me long enough to force down. A female catheter was used, but it struck against some solid body that prevented its progress. After death the thyroid body was found to be much enlarged, but mainly below the sternum and along the sides of the trachea. The trachea below my opening was flattened laterally to within half an inch of the bifurcation; it was also twisted to the left, and was surrounded by the greatly enlarged and firm lateral lobe of the thyroid. The structure of this enlarged gland was clearly that of hypertrophy, not of cystic or other apparent disease. As an example of acute rapid hypertrophy of the thyroid, the case, says Dr. Bennett, "points to the propriety of regarding any acute enlargement of this gland in young people with more anxiety than we are perhaps accustomed to do," particularly, it should be added, when the lobes of the gland pass down behind the sternum.

Thyroidal Tumors, doubtless, exist, although they are not common; thyroidal *adenoid* innocent growths, as well as *cancerous* growths.

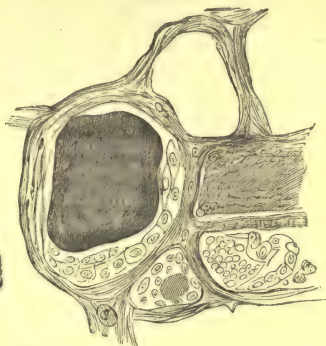
An *adenoid* growth may appear as a tumor within the gland itself, or connected with it, or more commonly as an intracystic growth, similar to that seen so frequently in the breast. In their clinical history such cases cannot well be diagnosed from the ordinary goitre, although, when the disease is unilateral, and assumes a rounded or irregular form, and appears to be an isolated outgrowth of the gland itself, the nature of the tumor may be suspected; when placed, however, within the gland itself, or within a

cyst in the gland, the diagnosis is impossible. In the figure below (Fig. 312), taken from a drawing by Dr. Moxon, of an old preparation in the Guy's Hospital Museum (1711⁴⁵), a tumor the size of a grape is depicted hanging down loosely by a pedicle attached to a lobe of the gland, and in the gland there is a well-marked, cup-like depression, from which the tumor had fallen out, the pedicle mainly consisting of a large artery emerging from the gland. The growth had an ossified capsule, and was composed of a structure like that of thyroid tissue (Fig. 313). A like case has also been recorded by my colleague, Mr.

FIG. 312.



FIG. 313.



Microscopical appearances of thyroid glands. (From Dr. Moxon's drawing.)

Poland, in which excision was successfully performed ("Guy's Hosp. Rep.," 1871). Frerichs, Rokitsky, and Virchow record somewhat similar instances. Paget thus refers to the subject of accessory thyroid tumors: "These growths of new gland tissue may appear not only in the substance of the enlarging thyroid, but external to and detached from the gland. Such outlying masses of thyroid gland are not rare near bronchoceles, lying by them like the little spleens one sees near the larger mass. Their history is merged in that of bronchoceles (see 'Virchow,' lect. 22), with which they are usually associated, whether imbedded as distinct masses in the enlarged gland, or lying close to it; but discontinuous."

Cancerous Growths appear as infiltrating affections of the gland, or as distinct tumors; they have no distinct clinical characters until they attack by continuity the tissues around or break down. The Guy's Hosp. Mus. contains four preparations of this disease.

Operative Interference in Thyroidal Tumors.—Many operative proceedings have been suggested and adopted for goitre and thyroidal tumors. Sir W. Blizard, Earle, and Coates ("Med.-Chir. Trans.," vol. x), tied the superior thyroid arteries, with the view of starving the disease, and in Coates's case with success; but the operation is necessarily a severe one, and the free arterial supply from the inferior thyroid arteries tends to neutralize its good; at the present day it is properly discarded. Setons have likewise been used for this affection, and with good success; they deserve a more extended trial; but excision is probably the only operation that is worthy of consideration when any operative measure at all is to be entertained. It need hardly be said, however, that no surgeon would venture to recommend the removal of a thyroid gland or tumor, unless from its growth life was jeopardized, and less severe measures had failed or were inapplicable; under such circumstances the attempt is justifiable. That it can be done successfully has been proved by Dr. W. Warren Greene, of Maine; and in the "American Journal of Medical Sciences," for January, 1871, two such cases are recorded. Mr. Poland's case, already referred to, is another in point.

Hemorrhage is the chief danger to be dreaded in the operation, but if the fingers be well used to enucleate the growth, its capsule be not divided or cut into, and the pedicle, which contains the vessels that supply it, be

rapidly reached and ligatured, bleeding may be disregarded. As an extra point of caution it appears to be a sound practice to ligature all parts that require division before cutting them, in the same way as the surgeon does in ovarian cases, and for the same reason. Should the tumor turn out to be an adenoid growth, in or connected with the gland, as in Poland's case, it may be removed with comparative facility, and should it be an enlarged gland itself, even a pound and a half in weight, success may follow, as proved by Greene. Indeed, I cannot do better than give the several steps of the operation in Dr. Greene's own words:

1st. Exposure of the tumor by linear incision of ample length, avoiding most sedulously any wounding of the tumor or its fascia propria.

2d. Division of the fascia propria upon the director.

3d. The reflexion and the enucleation of the tumor with the fingers and handle of the scalpel, paying no attention to hemorrhage however profuse, but going on as rapidly as possible to the base of the gland, and compressing the thyroid arteries.

4th. Transfixion of the pedicle, from below upwards, with a blunt curved needle, armed with a double ligature, and tying each half, or, when practicable, dividing the pedicle into as many portions as there are main arterial trunks, and tying each portion separately.

5th. Excision of the gland, and subsequent dressing of the wound, as in ordinary cases.

I cannot also forbear from quoting his concluding remarks, they are so full of sound sense and wisdom. In conclusion, he writes: "I cannot refrain from one word of warning to my younger brethren, whose ambition may make their fingers tingle, lest they should, in the light of these successful cases, be too easily tempted to interfere with these growths. It is, and always will be, exceedingly rare that any such interference is warrantable, *never* for relief of deformity or discomfort merely; only to save life, and if it is, beyond all question, determined in any given case that such an operation gives the only chance for snatching a fellow-being from an untimely grave, be it remembered that accurate anatomical knowledge, and a perfect self-control under the most trying ordeals through which a surgeon can pass, are indispensable to its best performance."

CHAPTER LXVIII.

CONTUSIONS, SPRAINS, AND WOUNDS OF JOINTS.

Sprains are more or less severe strains, if not lacerations of the ligaments that bind the bones of an articulation together, and other muscles and tendons that surround it, without displacement of the bones of the joint.

Contusions should always be regarded in a serious aspect, for a large amount of internal injury may often be sustained with very slight external evidence of mischief, and under certain conditions of health a slight blow or sprain is often enough to set up severe local action or excite chronic changes which may involve the integrity of the joint. The nature of the accident and the amount of force concentrated on the joint is, therefore, the best index to the case, and under all circumstances the prognosis should be guarded and the treatment cautious.

TREATMENT.—In simple cases it is often enough to restrain the move-

ment of the joint, and to keep it at rest for a few days, when if no harm is to accrue, convalescence will be established. Should swelling and effusion into the joint ensue in the course of the second or third day after the accident, the evidence of internal injury is more marked, for such effusion means inflammation or synovitis; it is to be treated by absolute rest, possibly by the application of a splint, and the local use of ice, or cold lotion, leeches and warm fomentations, according to the comfort cold or warmth affords.

Should swelling of the articulation follow immediately upon the injury, effusion of blood into the joint is indicated; with or without fracture, but always with severe local mischief. Such cases are to be treated by the local application of a splint to insure immobility of the articulation, elevation of the injured joint, with the patient reclining, and the local application of a bag of pounded ice, or irrigation with cold water, these means being maintained till the blood is absorbed, all risks of inflammation of the joint have passed, and repair appears to be going on satisfactorily. But it is well in these cases to restrain the movements of the joint for several weeks subsequently by the application of strapping, the pressure at the same time tending to hasten the absorption of the effused blood.

When the muscles over a joint, such as the shoulder, are severely bruised by a fall, much local pain is produced, and want of power in the arm, leading the surgeon to suspect some bone or joint mischief; but on making a careful examination, it will be made out that the joint can be moved by the surgeon without exciting pain if no roughness in the examination be used, although if the patient attempts to set the muscles in action, pain is at once excited. This point is one of clinical importance, for it indicates that the mischief is in the muscle, and not in the articulation, the pain being excited by muscular action, but not by joint movement.

In delicate children, all falls upon the hip, followed by pain, should be treated by rest and extreme care; for a large number of cases of hip disease originate from some such slight cause, and there is good reason to believe that the majority might be prevented by slight attention.

When the immediate effects of the sprain have passed away, the local use of some stimulating liniment and moderate friction of the part expedites the cure, at the same time giving comfort to the patient. A local warm bath at intervals relieves the stiffness of the joint, but its use must be very limited for many weeks if the sprain has been severe. Whenever movement excites more than a momentary pain, rest should be observed; if the pain continues, some chronic inflammatory change is to be suspected and treated. When weakness only of the joint remains, a good bandage or strapping around the part to give support is of great use. Where much laceration of ligament has taken place, it is sometimes necessary for the joint to have some permanent artificial support, either in the form of a splint, felt, or leather casing, or bandage, for no parts repair with less permanent power than ligaments.

In the wrist, where much swelling exists, a sprain may be mistaken for a fracture, or a fracture for a sprain, for fractures about the end of the radius are generally impacted, and are not consequently attended by crepitus; much care is called for in the diagnosis of such cases. Many sprains of the ankle are also really cases of fracture of the fibula above the malleolus. The popular notion that a severe sprain is worse than a fracture is in the main true, and, when the sprain is neglected, is so actually.

Wounds of Joints are always serious accidents, yet as a whole if treated with discretion, and at an early period of their existence, they are fairly successful in their issue. Lacerated, incised, and punctured wounds are met with, and the symptoms that follow any one of these accidents are by

no means commensurate with the extent of the local injury, for a slight or punctured wound is often followed by severe and destructive local changes, when an extensive one heals without giving rise to any mischief.

A joint is known to be wounded when its contents escape, as synovia has very definite characters, its oily, glutinous nature rendering its flow very manifest. In fat subjects wounds over joints give exit to oily fluid simulating "joint oil;" such fluid, however, is not sticky when rubbed between the fingers as is synovia. Yet joints are sometimes wounded without any evident escape of their contents, and doubtful cases are clinically to be treated as cases of wound. In every case of wounded joint, however trivial, the *prognosis* must be very guarded and the *treatment* cautious. Doubtful cases of wounded joints are to be treated with the same caution. In all cases the joint should be kept in absolute repose, the application of a splint being desirable; the wound should be well cleansed with warm water, and its edges accurately adapted with sutures when necessary. The best local application is ice or cold water irrigation, the constant flow of cold water over the part having a very beneficial tendency. Probing the wound is to be avoided. The cold, however, to be of value must be persistently applied; any intermission of its use is almost sure to be followed by increase of pain and of effusion. Nothing checks pain more or subdues inflammation and effusion better. To seal hermetically a wound with a piece of lint soaked in the compound tincture of benzoin, and the local application of an ice-bag is excellent practice. Should an interval have passed between the receipt of the accident and the application of the cold, and much joint inflammation exist with constitutional symptoms, the local application of leeches and subsequently of cold is of great value. In exceptional examples where cold is not tolerated, warm fomentations must be substituted; but as a means of controlling inflammatory action such a practice is not half so beneficial. Recently the plan of applying carbolic acid dissolved in oil to the wounded joint, and lint saturated with the same over the wound has been attended with good success. Opium under these circumstances is always of use, the patient being kept fairly under its influence; one grain two or three times a day is the usual dose. Mercury is useless. In very sthenic cases antimony may be given, and colchicum where gout is suspected.

When all acute symptoms have subsided and chronic effusion remains, the application of a blister or blisters expedites the absorption of the effused fluid, and the benefit of pressure by the adjustment of well-applied strapping is very great. In feeble patients tonics are required. Should suppuration appear, active treatment is called for, such as a free incision into the joint, or other means, which will be considered under the heading of suppurating joints.

Extensive wounds of large joints complicated with other injuries had better be treated by amputation or excision.

CHAPTER LXIX.

DISLOCATIONS.

A JOINT is said to be dislocated when the articular surfaces of one bone is displaced from another; when wholly displaced it is called "*complete*," when not so, "*partial*" or "*incomplete*."

When the dislocation is associated with a wound communicating with

the joint it is known as a *compound* dislocation; when not so associated, as a *simple* one.

It would be well, also, if the term were applicable only to cases caused by violence; for congenital dislocations are cases of malformation, and the displacements of bones produced from disease are accidental complications of a more serious affection. In the present chapter neither of these two conditions will receive attention.

Dislocations are mostly caused by external violence, but they occasionally occur from muscular action. Dislocation of the lower jaw is the most familiar illustration of this fact. I have known, however, the head of the humerus to be displaced from the violent throwing of a stone, and from the spasm of muscles in an epileptic fit. I have seen, also, the hip-joint dislocated from mere muscular action. Schoolboys are familiar with the dislocation of the thumb at the carpal joint, which some young persons, who possess relaxed ligaments, are capable of producing at will.

Laceration of the ligaments more or less complete is a necessary accompaniment of all dislocations; of the ligaments that bind the bones together, as well as of the capsular ligament, although it is probable that in partial dislocation the capsular ligament may be stretched and not lacerated. The muscles and soft parts that surround the injured articulation are also generally much torn. At times the nerves are pressed upon or lacerated, as at the shoulder, and the main artery is divided, as at the knee. In some joints, as the ankle, dislocation is mostly complicated with fracture.

When a dislocation has been reduced, however, most of these injuries are steadily repaired, although some weakness of the joint often remains. When nerves have been injured, some local paralysis or want of power in the muscles supplied by the injured nerves are occasional results.

When a dislocation has been overlooked or neglected, other secondary changes take place, and in a measure they are to be regarded as reparative, for a *new joint* is formed, inflammatory products being poured out around the bone in its new position, which organize and ossify, and thus form a fresh articular cavity (Fig. 314). This cavity becomes lined with a dense layer of fibrous tissue, putting on the external aspect of, and serving as well as, cartilage. The head of the bone becomes at the same time altered in shape, and surrounded by what answers for a new capsule—made out of the cellular tissue of the part—and a large amount of mobility is often secured, particularly in the ball-and-socket joints. The original articular cavity also often becomes gradually filled in with fibrous tissue. The muscles, tendons, and soft parts, that have been torn or misplaced, make fresh attachments, ossific matter often being deposited in the tendons, and it is in this way the mobility of joints after dislocation is at times interfered with.

How long these secondary changes take to form is not yet decided. In some patients they doubtless occur more rapidly than in others, and in some very slowly, for Broadhurst and Fournier both ("St. George's Hosp. Rep.," 1868) record a case in which the cartilage of the acetabulum was found healthy, and the cups still unfilled, three years and ten years respectively after a dislocation.

FIG. 314.



From Sir A. Cooper.

Diagnosis and Symptoms.—Typical examples of dislocation, when seen at an early period of their existence, are not difficult of diagnosis; although partial dislocations, and even complete ones, when seen some days after the accident, when swelling of the parts has taken place, are often obscure; at any rate, the frequency with which such cases are overlooked, even by good men, forbids our saying they can always be made out.

In every case of suspected dislocation the surgeon should always compare the sound side with the injured one. In doing this, he will at once detect the most obvious result of any dislocation, *deformity*, and be able to make out the direction the displaced bone has taken. He will see whether the limb be longer or shorter than its fellow, abducted or adducted.

The patient will not only have lost all power of voluntary movement, but the surgeon, by grasping the affected extremity, will probably find, where dislocation exists, that the movements of the joint are very limited, and that the attempt causes severe pain. There will also be an absence of crepitus, unless some days have passed since the accident, when the crepitus of effusion into the joint, into the bursæ about the joint or tendons, will often be felt. Deformity, loss of the power of voluntary motion, and impaired actual mobility, coming on after an accident, are the three most marked symptoms of dislocation; by themselves, with the absence of crepitus, they are enough to enable the surgeon to diagnose a dislocation from a fracture, although possibly they are not enough to distinguish it from a separation of an epiphysis. Holmes, with his usual clearness, writes upon this point ("System," vol. v): "Separations of epiphyses are distinguished from dislocation by the following characters: (1) The former can only occur at ages at which the epiphyses are separate from their shafts, the latter at any age. (2) The former are, as a rule, easy to reduce, and difficult to retain; in the latter, as a rule, these conditions are reversed. (3) In the former, the points of bone immediately surrounding the joint preserve their normal relations; in the latter, these relations are variously altered. (4) The sensation perceived in the two injuries is different, for separation of an epiphysis is usually complicated with fracture, and therefore crepitus can be elicited.

TREATMENT.—The reduction of the dislocation as soon as possible after the accident is the general rule in surgery, delay being only justifiable when the appliances required are not at hand. Most dislocations, not excluding those of the hip, may be readily reduced directly after their occurrence by extension or manipulation, without the aid of chloroform; but when any time has been allowed to pass away, and the immediate constitutional effects of the accident have subsided, it is a fair question whether it is advisable to attempt reduction before anæstheticizing the patient; for without chloroform, under the most favorable circumstances, much force will to a certainty be called for, but with it the gentlest manipulation is often enough to enable the surgeon to reduce a dislocation even of the hip. I believe it to be wiser for the surgeon to delay his attempt to reduce a dislocation till chloroform can be obtained than to make it without, for the slight harm that ensues from the delay is more than compensated for by the great good secured by its use. Chloroform has superseded the old treatment by venesection, tartar emetic, the string of students, and the pulleys; with its use all muscular spasm ceases to be a force which has to be overcome, and the surgeon has simply to replace the bone, through the rent in its capsule, by such gentle manipulative acts as the special requirements of each case appear to indicate. The facility with which a dislocation is reduced by manipulation turns much upon the surgeon's knowledge of the way the dislocation was produced, for, in a general sense, the best

way to reduce a dislocation is to make the head of the bone *retrace* the course it followed when it burst through its capsule, for the rent in the capsule is doubtless the main obstacle to reduction, muscular spasm being eliminated by the use of chloroform.

In no department of surgery is the benefit of chloroform better demonstrated; where force reigned, gentleness now rules, and where difficulty and pain were common accompaniments, facility of reduction and painlessness are now the rule.

In neglected cases of dislocation, where false joints exist and force is called for to break them down, pulleys may occasionally be wanted, but they must always be employed with the greatest caution, and under a healthy fear, for not only may the axillary artery be torn and ligaments lacerated, but worse injuries may ensue; thus in Paris, in 1864, the forearm of a woman, æt. 64, was torn off at the elbow-joint in the attempt to reduce a dislocation of the humerus.

After the reduction of a dislocation the joint should be kept at rest, fixed by bandages sometimes on a splint; when any signs of inflammation show themselves, cold, in the shape of ice in a bag, should be employed; leeches are seldom called for.

Three or four weeks are at least required for repair to take place before any useful free movement of the joint can be allowed, although when no inflammatory symptoms appear, passive movement may be permitted at the end of two weeks; but in dislocation of the hip no walking or standing should be sanctioned for the full month. No pressure over the joint should, however, be allowed, Sedillot's rule of "simply placing the joint in a position the opposite of that in which it was when the dislocation occurred" is a sound one.

When reduction cannot be accomplished after a reasonable attempt, a second one may be made at a subsequent period after the effects of the first have passed, that is, if any sound hope exists of success being secured; some modification of the means employed probably suggesting themselves to the surgeon upon his turning over in his mind the peculiarity of the case and the cause of his failure.

When the patient is an adult the difficulties and prospects of the case should be laid before him and his opinion taken, not as to the desirability or the reverse of the attempt, for such an opinion belongs to the surgeon and his colleagues only, but as to the risks that are to be run, for in many cases failure of reduction, more particularly of forcible reduction, is followed by some destruction of the new joint that nature might have partially formed; by some inflammatory changes that may end in the destruction of the joint, or in rendering its usefulness still less promising.

With respect to the propriety of attempting the reduction of an old dislocation, no definite rule can be laid down, and those originally given by Sir A. Cooper and generally followed require modification since chloroform has been introduced. Sir A. Cooper gave three months as a limit to the attempt in the shoulder, and eight weeks in the hip; yet Sedillot reduced a dislocation of the shoulder more than a year after its receipt, Broadhurst on the 175th day, Smith (U. S.) at the seventh month and tenth month; whilst Breschet reduced a dislocated hip on the seventy-eighth day, Travers at the fifth month, Blackman (of Cirencester) at the sixth month. Yet such cases must be rare. Ball-and-socket joints are also more readily replaced than others. The best guides the surgeon possesses for his decision are found in the amount or absence of repair that is present in the dislocated joint. When the movement is good there is small reason for making the attempt; for, writes Fergusson, "after three months the use of the limb is

not, when reduced, greater than that which it would have acquired in its dislocated state."

And when the movements are very limited, a cautious attempt to reduce the dislocation is hardly likely to be followed by a bad result, at whatever period; but, as previously stated, the patient and surgeon should take council together on the point, and share responsibility.

To reduce an old dislocation, it is needless to say some anæsthetic should be employed, and all adhesions freely broken down by free rotation or forcible movements of the joint. When this has been effected, the head of the bone ought to be replaced by the hands of the surgeon, by manipulation, or by slight extension—forcible extension being inadmissible. When tendons are very rigid and forbid movement, they should be divided subcutaneously, but this should be done some days before reduction is fully attempted. Brodhurst sums these points up well, and I adopt his words: "In old dislocations recourse is to be had to manipulation, with or without the previous subcutaneous sections of tendons rather than to the pulleys and violent extension of the limb. Violent extension may occasion rupture of vessels and nerves, as well as of the integument and muscles; it may even occasion fracture. But these accidents cannot occur when manipulations are employed to restore the limb after the adhesions have been ruptured."

Compound dislocation is one of the most serious accidents that can befall a limb. In the larger joints it is rarely uncomplicated, bones being either fractured or arteries torn. In the knee-joint the popliteal artery is generally lacerated, and under such circumstances amputation is the only resource. In the ankle-joint, where the accident is most commonly seen, the case is to be treated as one of fracture and wounded joint, by immovable splints after its reduction, and the persistent application of cold, either by means of ice or irrigation; in exceptional cases only, when the soft parts are much injured, or in very feeble subjects, ought amputation to be thought of; excision of the articular surface is always a point for consideration. In the elbow, where movement is of essential importance, when the wound is large, excision had better be performed. Under all circumstances the dislocation is to be reduced, the question of excision or amputation turning upon the amount of mischief the soft parts or bones have sustained.

Compound dislocations and compound fractures into joints are clinically of very similar import.

When *dislocation and fracture coexist* difficulties are often met with, but with chloroform the reduction of the dislocation is often possible by manipulation, where without, it is impossible. I have reduced under chloroform the head of a fractured humerus (subglenoid) in one case, and a forearm displaced backward with fractured arm-bone in another, and in each case adjusted the fracture subsequently with facility; and I have seen the head of the femur resting upon the pubes, pressed back into its socket, notwithstanding that a fracture of the shaft existed. I believe that in the majority of these cases the dislocation may be successfully treated before the fracture, the fractured bone being at the same time moderately extended. In some cases it may be prudent to apply splints before attempting the reduction of the dislocation, but such a step is not always necessary, or indeed advisable, for with the limb incased in splints the surgeon has less influence upon the dislocated bone; and with care the fracture will be but slightly interfered with.

CHAPTER LXX.

DISLOCATIONS OF THE UPPER EXTREMITY.

DISLOCATIONS of the spine and lower jaw have been considered in former chapters. Those of the upper extremity will now occupy our attention.

Dislocations of the clavicle at its sternal end are rare accidents; according to Flower they form about 3 per cent. of all dislocations of the upper extremity. They are produced by violence applied to the shoulder when the scapula is fixed, the clavicle being forcibly thrown towards the mesial line. Dislocation downwards is an impossibility, the cartilage of the first rib preventing such a displacement; but the bone may be dislocated *forwards, upwards, or backwards*, and these may be partial or complete.

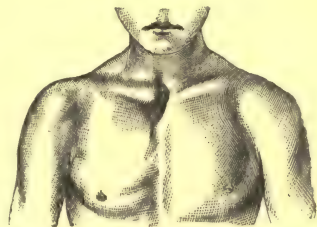
Dislocation forward is usually caused by some violent pressure of the shoulder backwards, although Méliér ("Archives Gén. de Med.," tom. xix) records a case where in a child it was produced by simply pulling the arm. When *partial*, some unusual prominence of the end of the bone on comparing it with its fellow will indicate its presence, the bone being only covered with skin and readily pressed back. When *complete*, the nature of the accident will be still better marked; and the end of the bone will be usually found depressed, pointing downwards. The head of the bone forms a marked feature in this accident, and cannot well be mistaken for anything else (Fig. 315). Inflammatory thickening of the joint should not be mistaken for partial displacement.

TREATMENT.—There is usually little or no difficulty in reducing this form of dislocation by forcibly drawing back the shoulder and applying pressure to the displaced bone; but there is great difficulty in keeping the bone in its normal position; indeed, as a rule, it is quite impossible to do all the surgeon wants. A pad in the axilla, with a figure-of-8 bandage to keep the shoulder outwards and backwards, will do much towards the desired end; and a good pad of lint applied over the clavicle just outside its displaced end, firmly fixed in position by strapping carried over the shoulder and scapula, has a very beneficial tendency.

Nélaton advises the use of a common hernia truss; but the surgeon must expect a certain amount of failure in the treatment of the case, although he may safely assure his patient that the usefulness of the arm will be but little if at all impaired. I have had one case of this dislocation, combined with fracture of the sternal end of the bone, in which no harm followed its non-reduction.

Dislocation upwards is very rare. Malgaigne has recorded four such cases, and Hamilton one other, described by Dr. Rochester, of Buffalo. I find by my notes that in 1865 such a case came under my care. It was in a young woman, a milliner, æt. 20, who two years before when in a crowd was violently crushed; the pain was referred to the upper part of her chest. She was treated at home and got well, a deformity remaining. For this

FIG. 315.



Drawing 27th, Guy's Mus. Dislocation of sternal end of clavicle, forwards.

she consulted me. On examining her chest, both clavicles were resting upon the upper border of the sternum, and with the slightest pressure upon the shoulders the two ends could be made to meet. By drawing the shoulders backwards the bones could be separated and pressed back into what appeared to be their normal position, but no appliance could keep them there. The patient had good movement in her arm, and could follow her occupation. I was disposed at the time to question the history of the case, although the report was given with an air of perfect truth; but on reading carefully the cases recorded I have now no doubt as to the real nature of the accident.

I have the notes also of a second case that came under my care in 1863, in a man, æt. 35; it was produced by a fall on the shoulder.

In the Guy's Museum (1292⁰⁰) there is a specimen of dislocation of the clavicle at its sternal end upwards and forwards.

TREATMENT.—The same difficulty is experienced in the treatment of this form of dislocation as in the last. There is none in reducing it by drawing back the shoulders and applying pressure upon the bone, but there is much in keeping the bone in position. The application of a pad and strapping over the bone, and the firm pressure of the scapula against the ribs by means of broad bands of strapping are the best means in this as in all other dislocations of the clavicle. Under all circumstances, however, the surgeon may comfort the patient by the assurance that good and useful movement of the arm will be secured. *Overhand* movements will, however, always be difficult.

Dislocation backwards, in point of rarity, stands next to that of dislocation upwards. I have seen but one such case, in a man, æt. 52, who was crushed by falling bricks. The second day the dislocation was self-reduced when the man was in bed. It is usually caused by violence forcing the shoulder forwards or by direct force. At times the displaced clavicle presses upon the trachea and œsophagus, so as to interfere with respiration and deglutition. In 1845 such a case was admitted into Guy's; it occurred in a sailor, æt. 17, from a blow on the shoulder. The bone pressed on the trachea and œsophagus. It was easily reduced by drawing the shoulders back, and was also maintained *in situ* without difficulty. Cases of this kind have been recorded by Mr. Brown, of Callington ("Med. Gaz.," 1845), and M. Pellioux, in 1834 ("Revue Medicale"). In one singular case, recorded by Sir A. Cooper, the dislocation was produced by curvature of the spine, and Mr. Davie, of Bungay, excised the sternal end of the bone to prevent death from suffocation. Mr. De Morgan has recorded a case in "Holmes's System," vol. ii, p. 805, in which the bone was thus displaced, in a girl, æt. 10, and successfully treated by means of a splint across the shoulders, with a pad between it and the spine, the shoulders being drawn to the splint by a bandage. The splint was removed at the end of a fortnight, the child being kept in bed. The articulation became, in four weeks, as firm as that on the other side, and the arm could be moved without causing any pain.

Dislocations of the Scapula.—These were formerly called dislocations of the acromial end of the clavicle; but the clavicle being a fixed point, it seems only consistent with common sense, although not with custom, to follow Skey, Maclise, and Flower, and call what have hitherto been described as *dislocations of the acromial end of the clavicle* dislocations of the scapula. In the more usual form of this accident the acromion process of the scapula is forced *beneath* the clavicle. In rare cases it may be received *above* it. Both are commonly caused by direct violence to the shoulder.

The *symptoms* are well-marked in both forms; the falling of the shoulder and projection upwards of the acromial end of the clavicle in one (Fig. 316), and the projection upwards of the acromion process of the scapula in the other prevent any mistake being made.

TREATMENT.—In the dislocation of the scapula downwards the aim of the surgeon is to raise the scapula with the arm and depress the clavicle, and this is best done by the application of a pad over the clavicle, and fixing it by a belt or bandage passed over the clavicle and round the elbow; on the one hand the belt pressing the clavicle downwards, and on the other raising the shoulder and arm upwards.

At times the parts fall into position when the patient assumes the horizontal posture, and when this is the case, and the position can be maintained for two or three weeks, it is well to adopt it. At other times a pad fixed over the clavicle by means of strapping, or a bandage passed beneath the axilla will suffice; but the surgeon, recognizing the special wants of the case, must adapt his means to meet them in the best way he can. Good movements of the arm are, as a rule, acquired in time after either of these accidents.

Dislocations of the Humerus.—These form at least half of all dislocations. The globular form of the head of the humerus, the shallowness of the glenoid cavity, the free movement of the articulation, and its liability to direct and indirect injury, afford a sufficient explanation of this fact.

In 40 out of 60 cases I found a direct blow upon the shoulder was the cause of the accident. In the exceptional cases a fall upon the extended arm or elbow, or a forcible dragging backwards of the arm, was the assigned cause. The accident is rare in childhood, although I have seen an instance of it at the age of 13; and Flower and Hulke have recorded a case in an infant 14 days old. Two-thirds of the cases are found in men between 50 and 70 years of age, it being comparatively rare in women and in young adult life. I have treated one in a man aged 75.

Analysis of 60 consecutive cases.

Out of 60 cases 31 were subglenoid, or downwards; 25 subcoracoid, or forwards; 4 subspinous, or backwards. 49 were in males, 11 in females.

4	in subjects under 20 years of age.
17	“ between 21 “ and 50.
38	“ “ 51 “ “ 70.
1	aged 75.

The head of the humerus may be dislocated—1. *Downwards—subglenoid.* 2. *Forwards—subcoracoid.* 3. *Backwards—subspinous.* The *subclavicular* dislocation is very rare.

When the coracoid process has been broken off, the head of the bone may be displaced over its root; two or three such cases are on record.

Subcoracoid.—The most common form is doubtless the subcoracoid, the head of the humerus resting on the anterior lip of the glenoid cavity beneath the coracoid process, or even more forwards, the completeness of this dislocation turning upon the amount of laceration of the attachment

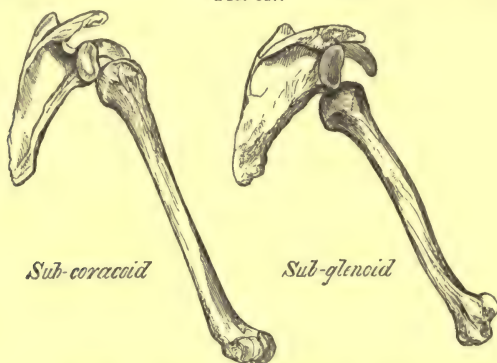
FIG. 316.



Mr. Poland's case.

of the posterior scapula muscles. When they are completely torn through at their insertion into the great tuberosity, or the tuberosity is torn off, the head of the bone will be more forward than when they are only stretched or partially divided. Many of the cases described by Sir A. Cooper as dislocation downwards, or of partial dislocation, were doubtless of this kind; and many others recorded as examples of subclavicular are nothing more than specimens of this variety. (Fig. 317.)

FIG. 317.

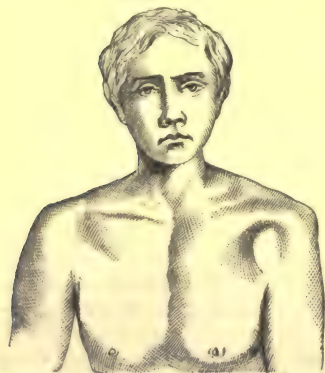


From Mr. Flower's models, Middlesex Hosp. Mus.

Flower has shown ("Path. Soc.," vol. xii) that 31 of the 41 specimens of dislocation of the shoulder-joint found in the London Museums belong to the subcoracoid class.

Symptoms.—The symptoms of this form of dislocation in their general character are the same as in most others, such as inability to move the arm, immobility and pain in the part, often passing down some nerve trunk, and aggravated by movement. On looking at the part and comparing the injured with the sound side before swelling has appeared, some striking points will be observed, such as flattening of the deltoid, prominence of the acromion, and a depression beneath it. Extra prominence will also be seen below the coracoid process, from the head of the bone pushing forward the pectoral muscle (Fig. 318); from behind there will be some flattening of the shoulder. There will be little or no lengthening of the limb, but the elbow will be found projecting from the side; at times, however, touching it, the movements of the forearm being perfect. On manipulating the shoulder the head of the bone will be felt beneath the pectoral muscle in front of the scapula, and on rotating the bone from the elbow it will be made to move.

FIG. 318.



Drawing 27th. Subcoracoid dislocation of head of humerus.

Dislocation downwards or Subglenoid.

—This form, although usually given as the most common, is second in frequency to the one last described, the subcoracoid. Flower says that not one in ten of all dislocations of the humerus can properly be called subglenoid. In it the head of the bone

rests below the glenoid fossa (Fig. 317), the rent in the capsule being at its inferior instead of its anterior border, and the soft parts mechanically interfering with the natural tendency of the deltoid, coraco-brachialis, and biceps to draw the head of the humerus upwards towards the coracoid process.

Symptoms.—Immobility of the arm, and inability to move it without pain, with a greater separation of the elbow from the side, a more marked flattening of the shoulder, greater depression beneath and extra prominence of the acromion than are met with in the subcoracoid, are the most constant symptoms. A typical depression of the anterior fold of the axilla from a drawing down of its attachment, and the fact that the head of the bone may be felt in the axilla, and the coracoid process and the head of the malplaced bone are separated by a space of one to two inches, render the diagnosis sure (Fig. 319).

Dislocation backwards or Subspinous.—This is next in rarity to the last. The head of the bone rests beneath the spine of the scapula or base of the acromion (Fig. 320); the latter position is a less complete luxation than the former, and is the more common. It corresponds to Malgaigne's "subacromial" variety, this completeness of the dislocation depending upon the amount of laceration of the muscles attached to the bone, and more particularly of the subscapularis.

The *symptoms* of this accident are very marked; looking at the shoulder in front, there will be the flattening of the deltoid and prominence of the acromion as usual, but there will be a marked flattening, if not depression, of the soft parts below the coracoid and acromion processes. The elbow, instead of being fixed away from the side, will be drawn to it and forward, the forearm generally pointing outwards. The back view, however, is the most typical, the head of the bone covered with muscles and soft parts forms a prominent feature in the case. I had a patient under observation about thirty years of age, who could dislocate her shoulder in this direction at will by muscular action.

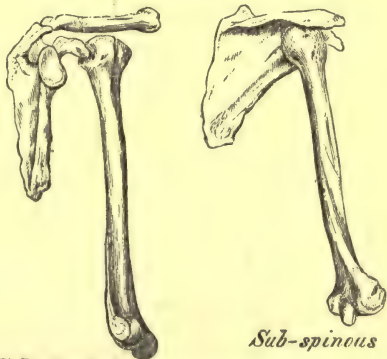
In all these dislocations an important point of diagnosis remains to be told; it was pointed out by the late Mr. T. Callaway in his excellent Jacksonian Prize Essay for 1849, and it is this: "*That in taking the vertical circumference of any shoulder in which dislocation exists by means of a tape carried over the acromion and under the axilla, an increase of about two inches over the sound side is an invariable concomitant.*" The same author also shows how elongation of the limb does not take place, at any rate to any extent;

FIG. 319.



Subglenoid dislocation.

FIG. 320.



Sub-clavicular

Sub-spinous

From Flower's models, Middlesex Hospital.

the different accounts given by authors depend upon the fact that they are content with optical rather than actual measurement.

Subclavicular Dislocations.—These are most rare. The head of the humerus rests below the clavicle on the sternal side of the coracoid process (Fig. 320). I have never seen a complete example. Malgaigne tells us that in it the arm is pressed against the chest, the elbow slightly removed from the side, the head of the bone is felt and also seen in its abnormal position; the shaft of the humerus is felt in the axilla instead of the head. The bulk of cases recorded as of the subclavicular kind are probably subcoracoid.

The **supracoracoid** dislocation is a mixed form of accident, for it is secondary to a fracture of the coracoid process. Malgaigne has recorded an example, and Holmes, in the "Med.-Chir. Trans.," vol. xli, a second, with an account of the dissection of the case, the preparation being in St. George's Museum. He also relates a third, which occurred in the practice of Mr. P. Hewett.

It sometimes happens that the head of the bone, after its apparent reduction, fails to remain in position and slips out again. When this occurs it becomes a question whether some part of the glenoid cavity is fractured or other fracture exists. In children it may be that the upper epiphysis of the humerus has separated. Under these circumstances the arm should be most carefully manipulated under chloroform to make the diagnosis sure. In exceptional cases, however, this slipping out again is not to be explained by these complications. In the case of a man, æt. 75, who had a dislocation backwards, the head of the bone could not be kept in position till the muscles began to act after the effects of the chloroform had subsided. I had to hold the bone in place till the patient recovered, and the muscles acted naturally.

TREATMENT.—The use of anæsthetics has completely revolutionized the treatment of dislocations, and at the present day nothing can usually be simpler than the reduction of a dislocation of the shoulder. What was then called reduction by *stratagem* is now the rule. "If you can get a person off his guard," wrote Abernethy, "you have first to put your hand up to the head of the bone, depress the elbow, and it will sometimes succeed in putting it in," and the modern surgeon, in describing the reduction of dislocations by *manipulation*, might use much the same language. To reduce a dislocated humerus by *manipulation* chloroform is essential, and when the patient is *fully* under its influence and in the horizontal posture the surgeon should grasp the shoulder with one hand, and the flexed elbow with the other (Fig. 321). When the dislocation is subglenoid or subcoracoid the thumb of the surgeon may be placed over the head of the bone and the fingers over the spine of the scapula, the thumb acting as a fulcrum; with the other hand the flexed elbow should be drawn from the side and extension made, some slight rotatory movement outwards being employed. When extension has been carried to its full extent the elbow should then be raised and the arm made to describe a semicircle in the direction of the sternum and the face, and then suddenly brought down to the side of the thorax, the head of the humerus being rotated inwards, and the thumb of the opposite hand at the same time giving the right direction to the head of the bone. (Fig. 322.) Should the first attempt fail, a second may succeed, or even a third. In the majority of dislocations of the shoulder this method will succeed. In Philadelphia this practice is known as H. H. Smith's method. In the dislocation backwards or subspinous the same method will suffice, but in that case the head of the bone, being behind the glenoid cavity, wants pushing forward; under such circumstances the sur-

geon standing slightly behind the patient with one hand should grasp the axilla with the thumb behind, and with the other the elbow, making extension, reduction may then be effected by drawing the elbow backwards

FIG. 321.



FIG. 322.



Extension, adduction, and rotation outwards.

and rotating the bone. By these means I reduced an interesting case of dislocation backwards, subspinous, complicated, with fracture of the ribs of the same side and of the opposite clavicle, with facility. The case was one of Dr. Hall's, of Hornsey. When these means fail or when chloroform is not at hand, reduction by means of extension with the heel in the axilla should be employed, the surgeon with his unbooted heel pressing upon the head of the humerus or lower border of the axilla, and with his hands grasping the forearm of the misplaced limb, making steady extension; some slight rotatory movement often facilitating reduction. The head of the bone usually slips into its place with a perceptible jerk, and the moment this is felt all extension should be stopped.

To facilitate extension the clove hitch (Fig. 323) may be employed; and instead of the heel, Mr. Skey uses a well-padded iron knob, but it has no advantages.

FIG. 323.



If the humerus still resists, the following plan, writes Hulke ("Holmes's Surgery," vol. ii, 1871), which I have never known to fail in a recent dislocation, may be tried. The patient is seated in a high chair, which is placed about two feet from the post of an open doorway; the surgeon, having his back against the doorpost, places one foot upon the side of the chair, and with his knee presses into the axilla, and with both hands upon the shoulder steadies the patient's body, a jack towel is then fixed by a clove-hitch knot to the patient's arm, just above the elbow, and by its means two or three assistants, placed on the other side of the doorway, make steady extension horizontally outwards.

FIG. 324.



Reduction by extension of arm upwards.

This is only a modification of Sir A. Cooper's plan of bending the extended arm over the knee placed in the axilla with the patient sitting, using the humerus as a lever; it is, doubtless, a good one.

Should these means fail, success may be secured by drawing the arm vertically upwards, as practiced by White, of Manchester, in 1764. In 1864, I succeeded by these means in the case of a subglenoid dislocation of one month's standing, in a man, *æt.* 64, the method by manipulation and extension having failed; and again, more recently, in a simi-

lar case of twenty-four hours' standing, in a gentleman, æt. 30, when every other method had failed (Fig. 324). Mr. Lowe, of Burton-on-Trent ("St. Barth. Rep.," 1870), has recently advocated the same method, the patient sitting on the floor and the surgeon standing behind him on a sofa, the shoulder being kept fixed by the surgeon's foot placed upon it, and the arm forcibly extended upwards. In all cases the extension should be gradual and steady, the counter-extension effective; no jerking or great force should be allowed; pulleys are to be looked upon as dangerous appliances; with the use of anæsthetics they should be abandoned. In recent dislocations they are never needed; and in old ones adhesions should be broken through by forcible rotation, and flexion of a joint rather than extension. In quite recent dislocations of the shoulder reduction can usually be effected by means of extension with the heel in the axilla or across the knee.

Under chloroform, the reduction by manipulation is the most successful, and, when this fails, that by extension downwards or upwards over the shoulder will succeed. In a case of subspinous dislocation of three weeks' standing in a man, æt. 75, reduction was effected under chloroform, by extension forwards. In old dislocations reduction may be effected by extension downwards or upwards, after the free rupture of all adhesions.

In a neglected dislocation of twenty-five days' standing, Mr. Cock succeeded in 1859 (*vide* author "On Diseases and Injuries of Joints," 1859) by the following plan, all other means having failed: "An air-pad, made of vulcanized india-rubber, was placed in the axilla, and the arm firmly bandaged to the side, the air-pad thus being made to exert a powerful outward pressure upon the head of the bone. Upon removing the bandage upon the third day, the head of the bone was found to have returned to its natural position."

Without chloroform the difficulty in the reduction of a dislocation of the shoulder is found in muscular spasm, superadded to that of replacing the head of the bone through the rent in its capsular ligament. With chloroform the resistance of the muscles is no element to be considered, the second one alone exists. In old dislocations the presence of adhesions is an extra element of difficulty.

After the reduction of a dislocation the arm should be bound to the side for a week, and kept at rest for a fortnight or more, all violent exertion being forbidden for several months. The object of this is to give time for the injured parts to recover their power, for ruptured muscles to unite or form fresh adhesions.

At times it happens that the trunks of the nerves are so injured as to give rise to paralysis of the muscles supplied by them. I have seen, in one case, the parts supplied by the ulnar permanently paralyzed; and in another, those supplied by the musculo-spiral. It is by no means uncommon to find the circumflex nerve so injured as to be followed by a most complete wasting of the deltoid muscle.

The axillary artery may likewise be lacerated. Callender ("St. Barth. Rept.," 1866), has recorded such a case; and Dr. R. Adams ("Cyclo. Anat. and Phys.," art. "Shoulder," p. 416) another.

In neglected dislocation of the shoulder it is always a difficult question to decide as to the expediency of attempting reduction. Sir A. Cooper used to say that, after twelve weeks' rest, an attempt should not be made, and in a certain sense such an opinion is correct; but there are many cases of less standing, in which the attempt would be wrong, and some few, of far longer standing, in which it would be right.

Where good movement exists after twelve weeks, there is little need for the attempt, unless under exceptional conditions. When bad movement exists, or none at all, the attempt may be made, for cases are on record in which reduction has been effected after a year or more.

Compound dislocations of the shoulder are grave accidents, and when much injury to the soft parts is present, the best plan is probably to resect the head of the bone. When the wound is limited or clean, and reduction is easy, it may be right to treat the case as one of wounded joint.

Fracture and dislocation of the head of the humerus, at times, occur together, and when the dislocation can be reduced at once, as it may be by means of chloroform, so much the better. When it cannot, the fracture must be treated, and the dislocation left alone, good movement at times being the result.

In Fig. 325 such a complication existed. The preparation was taken from a gentleman, *æt.* 64, three months after the injury, before union had taken place at the seat of fracture.

Dislocation of the Elbow.—It is in early life that this accident is most common; according to the Middlesex Hospital table ("Holmes's Syst.," vol. ii), more than half of the cases occurred in boys between the ages of five and fifteen.

Dr. Hamilton out of 33 cases found 19 in children under fourteen years of age. At Guy's these proportions are not quite so large, for out of 13 cases 6 were in subjects between ten and twenty; 3 between twenty and thirty; 3 between thirty and forty, and one between forty and fifty. In only one case was the subject a woman.

Both bones may be displaced *backwards, outwards, inwards, or forwards, backwards and outwards, or backwards and inwards*. The *ulna* may be displaced backwards alone, the radius maintaining its natural position; the head of the *radius* may be thrown forwards or backwards.

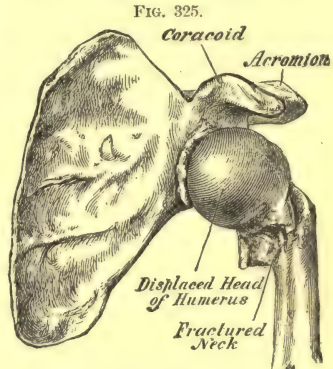
These dislocations may be, more or less, complete; they may be simple or compound; uncomplicated, or complicated with fracture of one or more of the bones entering into the formation of the joint, or displacement of an epiphysis.

In point of frequency dislocation of both bones backwards is the most common, the other dislocations of both bones occurring in the order above given; dislocation forwards being so rare that without a fracture its existence was doubted by Sir A. Cooper, but Velpeau and Canton have each recorded undoubted examples.

The force required to produce any one of these injuries is severe; it is generally a direct one upon the elbow, or an indirect one upon the hand, either a fall or a twist; to admit of any dislocation, there must of necessity be much laceration of the ligaments.

Symptoms and Diagnosis.—These accidents are not difficult to diagnose when seen at an early period of their existence, although after the lapse of some hours great difficulty may be experienced, swelling masking the points of bone, and thus rendering it difficult to make out their relative positions.

The injured joint should always be carefully examined, each point of



Prep. 1114²⁰, Guy's Hosp. Mus.

bone felt for, and its relative position with other points compared with those of the sound limb, and, although in all forms of dislocation or fracture about joints the surgeon should compare the sound with the injured side, in none can he derive greater assistance, or feel more forcibly the value of the rule than in dislocations of the elbow. The student should accustom himself to the manipulation of healthy joints, and learn where to place his finger upon their different prominences and depressions;

FIG. 326.



From Sir A. Cooper.

for having learned the normal conditions of a joint, he will find usually but little difficulty in discovering when a displacement has occurred.

When both bones are dislocated *backwards* (Fig. 326) the forearm is partially flexed and the hand slightly pronated, the bones projecting backwards make a prominent swelling with the tendon of the triceps, and the condyles of the humerus can readily be felt in front pushing the artery and soft parts forwards, the inner condyle of the humerus and the olecranon being far apart; the great increase in the antero-posterior diameter of the joint will be seen at a glance. In thin subjects the olecranon, and the head of the radius, can be readily felt in their abnormal position, the head of the latter bone being made through the hand to rotate in its new position.

In the dislocation of the bones *outwards*, the marked prominence of the inner condyle of the humerus as seen from behind is a typical feature (Fig. 327), and with luxation of the same bones *inwards* the external condyle is prominent.

In the rare form of dislocation *forwards* (Fig. 328), the loss of the olecranon from its right position, the unusual prominence of the condyles of the humerus, and the marked elongation of the forearm, are the chief fea-

FIG. 327.



Dislocation of the right radius and ulna outwards. Posterior view.

FIG. 328.



Canton's case. Dublin Quart., Aug., 1860.

tures. In dislocation of the *ulna backwards*, the pronation and twisting inwards of the hand, the great shortening of the ulnar side of the forearm, and projection backwards of the olecranon, mark the nature of the accident.

When the *head of the radius* is displaced alone forwards (Fig. 329), or

backwards, its absence from its natural position, and its presence in an unnatural one, can usually be made out; in the forward dislocation the flexion of the joint is eliminated.

FIG. 329.

Drawing 27th, Guy's Hospital. From dissection. Mr. Hilton's case.

In the backward (Fig. 330) the movements may be complete, more commonly, however, they are limited.

TREATMENT.—When the surgeon has once recognized the nature of the dislocation he has to treat there is little difficulty in its treatment, for with the patient anæstheticized and the muscles consequently paralyzed, there is rarely any difficulty in reducing any dislocation of the elbow by *manipulation*, or rather by moulding the joint into its right form; this may usually be done by the surgeon's hands, pressure being applied according to the wants of the individual case, guided by the known anatomy of the part. At times extension of the forearm is required, or the forcible bending of the forearm over the surgeon's knee or thumb, but in the majority of early cases the joint may be moulded into its normal position.

FIG. 330.



When some weeks have been allowed to pass without reduction, considerable force may be called for to break down the adhesions, forcible flexion and extension being then applicable.

Up to two months any dislocation of the elbow may be reduced, or rather an attempt at reduction may be made. After that date, when useful movement is present, the attempt had better not be entertained. When no movement exists it is justifiable. No definite rule can be laid down upon this point: each case must be judged upon its own merits. I have reduced a dislocation of the bones of the forearm backwards after nine weeks, with an excellent result, and have failed after five. What would be justifiable under some circumstances would be unjustifiable under others, the age of the patient, his position or occupation, and necessities, having as great an influence in guiding the surgeon as the time that has elapsed after the accident and the amount of useful movement in the joint.

When both bones are displaced or the ulna alone, the surgeon should grasp the forearm as a whole. When the radius is the bone displaced, the extending force should be applied from the hand.

After the reduction of the dislocation the arm should be kept in a sling, and cold lotion or ice applied, according to the amount of inflammation that ensues. When little inflammation follows, passive movement may be allowed after ten days or a fortnight.

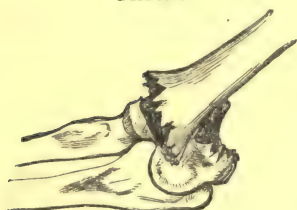
When reduction of a neglected dislocation has been effected, it is wise to fix the elbow upon an angular splint for ten days or a fortnight and apply cold, and after all inflammatory action has subsided, to allow of

passive or possibly forcible movements, for a stiff joint at the elbow is a misfortune of no mean importance, and to prevent it measures may be employed which, under other circumstances, might be considered rash. In neglected cases, where reduction is beyond all hope, the surgeon may use a considerable amount of force to flex the forearm to a right angle, in which position it should be fixed.

In *compound dislocation* of the elbow-joint, where reduction is possible and the wound small, the case may be treated as one of wounded joint—by splints and the application of ice, good hopes existing of a sound recovery being secured with movement. When the wound is large, and the soft parts are materially injured, excision of the joint should be performed, the success attending this practice being, as a rule, very satisfactory. When the vessels and nerves are clearly so injured as to preclude the possibility of a useful limb being secured, amputation may be required.

In all these dislocations of the elbow the surgeon should be careful to

FIG. 331.



Hutchinson's case.

make out that they are uncomplicated; that no fracture coexists; or, what is more common in young subjects, no displacement of the lower epiphysis of the humerus is present, such as is shown in Fig. 331. This can only be made out by a careful comparison of the sound and injured sides, and the appreciation of the crepitus of fracture, the crackling of effusion, and the semi-crepitating feel of a displaced epiphysis.

recorded as being of this nature being fractures of the lower end of the radius. Dupuytren pointed this out years ago, and the truth of the observation is now fairly recognized.

FIG. 332.



Taken from a cast of Mr. Cadge's, copied from Erichsen's work.

Dislocations of the Wrist.—These are exceedingly rare accidents, the majority of cases

being fractures of the lower end of the radius. What is now known as Colles's fracture is the more common form of accident.

When dislocation does occur the hand is displaced either *forwards* or *backwards*, the ends of the radius and ulna forming prominent points in the opposite positions, and the styloid processes of the radius and ulna being recognizable points in a line with the shafts of the bones of the forearm (Fig. 332). This feature is an important one, for when the displacement of the hand is due to a fracture of the lower ends of the radius and ulna the styloid processes will be in

connection with the hand instead of the shafts of the bones.

TREATMENT.—Reduction by manipulation is readily performed, extension of the hand and direct pressure upon the displaced bones, as a rule, effecting the surgeon's purpose. The parts should be kept in position by an anterior and a posterior splint; these should, however, be removed as soon as the parts have become firm, and passive movement of the fingers allowed.

Dislocation of the lower end of the radius may take place whenever the hand is forcibly pronated or supinated. When forcibly pronated, the ulna projects backwards and the radius and hand forwards; when supinated, the reverse conditions are found to exist.

Such dislocations are readily reduced by extending the hand and by the application of pressure to the displaced bones. After their reduction an-

terior and posterior splints should be applied for two or three weeks, to prevent the bones slipping out of position, and to allow the ligaments time to unite.

Dislocation of the carpal bones is an occasional although rare accident, the displacement of the *os magnum* backwards from a fall upon the flexed hand being the most frequent form. I have, however, known it to occur in a woman during the efforts of parturition in grasping a towel and forcibly bending the wrists, the bone being pressed out of its connection. The prominent head of the bone on the dorsum of the wrist in a line with the metacarpal bone of the middle finger is too marked a feature to allow of any difficulty in the diagnosis being felt. The bone is, as a rule, readily reduced by pressure, and kept in position by means of a pad. This pad must be maintained in position for many weeks after the accident to allow time for the ligaments to consolidate.

South records, in a note to his translation of Chelius, a case in which the *pisiform bone* was displaced; Fergusson and Erichsen both record others caused by overaction of the flexor carpi ulnaris. Erichsen also makes mention of a dislocation backwards of the *semilunar bone*, and in St. George's Hospital Museum there is a specimen of compound dislocation of this bone on both sides occasioned by a fall from a height upon the hands; the bones were pressed out of a wound in front of the wrist.

Maissonneuve has also recorded ("Mem. de la Soc. de Chir.," tome ii) a case in which the second row of carpal bones was displaced backwards from the first, and Erichsen a case, in which the metacarpal bones were displaced backwards from the carpus; these accidents are, however, very rare.

Dislocation of the thumb at any of its joints is not rare; the *metacarpal bone* may be displaced backwards or forwards from the trapezium, the former accident being the more common. Sir A. Cooper described a dislocation inwards, but gave no case. Dr. F. Hamilton questions its occurrence.

Reduction of these dislocations by extension and local pressure is usually readily effected, the bones being kept in position by means of a pad and a good splint extending some inches above and below the displaced bone.

Dislocation of the first phalanx from the metacarpal bone is a recognized accident, the displacement *backwards* being the usual form; dislocation *forwards* is a rare one. The first form is usually the result of a fall upon the distal end and palmar surface of the thumb, the distal end of the metacarpal bone projecting forwards, the base of the first phalanx backwards, and the extreme phalanx being flexed upon the first.

In some cases its reduction is effected with ease by simple extension or by the pressure of the surgeon's thumb upon the displaced phalanx. For the purpose of extension nothing equals in value the Indian toy called a "puzzle," or tube of plaited reed (Fig. 333). When this is not at hand strips of strapping fixed by a circular piece will answer the purpose. When these means fail, success may at times be achieved by flexing the thumb to an extreme degree, rotating and then suddenly extending it, this manœuvre, as it were, freeing the displaced bone from the many tendons and ligaments that surround the joint, and that doubtless, at times, interfere with its reduction. I succeeded by this method in one case where every other had failed. My friend, Mr. Sells, of Guildford, tells me that he has with facility reduced several dislocations of this form by forcibly

FIG. 333.



bending the thumb back, so as to tilt the base of the phalanx over the head of the metacarpal bone and then extending it.

In some instances all these means fail, and there is yet much obscurity as to the cause of the difficulty. The numerous muscles and tendons that surround the joint—and of these the short flexor is the most important—doubtless have a powerful influence, and when the wound in the capsule is small these muscles act more powerfully, the base of the displaced bone or the head of the metacarpal bone being held by these parts “as a button is fastened into a button-hole.” Sir A. Cooper thought the sesamoid bones had much to do with the difficulty. When this difficulty is felt, and all such means as have been mentioned have been tried and failed, the subcutaneous division of the tendons and ligaments that appear to prevent reduction has been practiced with variable success.

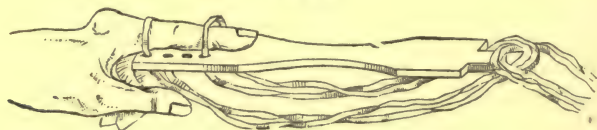
When these means fail excision of the part has been employed.

In a case of six months’ standing, when the thumb was a useless member and the seat of pain, I excised the joint with excellent success, a movable articulation being secured with hardly any deformity.

When the bone is displaced *forwards*, forced flexion of the thumb upon the palm is generally enough to effect reduction.

Dislocation of the ungual phalanx of the thumb may take place in either direction, forwards or backwards, the last being the more common, and the displaced bone being so small, difficulty is often felt in applying extension

FIG. 334.



to it. The puzzle (Fig. 333) is the best thing to employ for the purpose, or Levis's apparatus (Fig. 334). At times pressure with the thumb upon the displaced bone will succeed, or forcible flexion. Hamilton pithily advises “forced dorsal flexion in the case of the backward luxation, and forced palmar flexion in the case of the forward dislocation” (p. 634, ed. 3).

Dislocations of the phalanges of the fingers, like those of the thumb, may occur in two directions, the backward being the more common; they are readily made out and readily reduced by extension, or flexion and then extension.

CHAPTER LXXI.

DISLOCATIONS OF THE LOWER EXTREMITIES.

Dislocations of the hip are grave accidents; they are found mostly in male adults, between 15 and 45 years of age, but occasionally in the young or old. Mr. Powdrell (“Lancet,” 1868) has recorded a case in which the head of the femur was displaced into the foramen ovale at the age of six months, and reduced by manipulation. Erichsen has recorded another, of dislocation on to the pubes, in a child a year and a half old. I have seen an instance of dislocation on to the dorsum in a boy aged 6; but these cases are exceptional. On the other hand, they may occur in the aged; Malgaigne has recorded five between the ages of 60 and 85; I have treated

one in a man aged 73, and in another aged 66; but at this time of life fracture of the neck of the femur is more common.

The accident is always the result of violence, no slight intensity of force being required to tear through the ligaments that hold and bind the head of the femur in its deep pelvic cup; and were it not for the great leverage of the lower extremity, the accident would probably be a rarity. In exceptional instances the bone is displaced with the slightest force. I have had a young man under my care whose femur had been dislocated a dozen times or more, the smallest twist in the limb causing its displacement backwards.

Congenital dislocations and dislocation from disease are not entertained in this group.

Dislocations from accident are of various forms, but the division made by Sir A. Cooper is, doubtless, practically the best, if we remember that varieties of each form, called partial dislocations, are met with in practice; in fact, there is good reason to believe that the head of the thigh bone may rest at any point round its socket.

1. Dislocation *upwards* and *backwards*, on to the dorsum illi, is the most common.

2. Dislocation *backwards*, into the ischiatic or sciatic notch—a variety of the last—stands third on the list as to frequency.

3. Dislocation *downwards* and *inwards*, into the foramen ovale, stands second.

4. Dislocation *upwards*, upon the pubes, is about equal in frequency to that into the sciatic notch.

Bigelow, in his excellent treatise on the hip, shows how the thick ilio-femoral, inverted Y-shaped ligament of Bertin (Fig. 335) acts in determining the form of dislocation; the two backward dislocations being behind this ligament—that on to the dorsum being above the tendon of the internal obturator (Fig. 336), that on to the sciatic notch below the tendon, as illustrated in Fig. 338—and the two in-

FIG. 335.



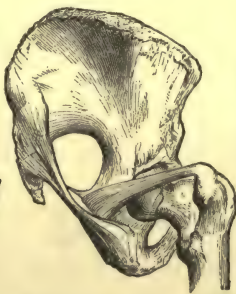
Bigelow's inverted Y-ligament.

FIG. 336.



Dislocation on to dorsum.

FIG. 337.



Natural relative position of the head of the femur to the obturator internus.

FIG. 338.



Dislocation on to sciatic notch, below tendon of obturator internus.

ward dislocations in front (Figs. 342-3). When the ligament is ruptured at its femoral attachment, some irregular form of luxation is allowed.

In all cases the round ligament and capsule is torn across, the muscles about the joint being more or less lacerated.

The following analysis of cases shows many of these points:

Out of 54 consecutive cases which have occurred at Guy's and in my own practice, 27 were on the dorsum, 12 into the foramen ovale, 8 into the sciatic notch, and 7 on to the os pubes.

Eleven occurred in subjects under 20 years of age, the youngest being 6; and 28 between the ages of 21 and 40; 15 had passed that period.

46 were in the male sex, and 8 in the female.

Dislocation on to the dorsum ilii, or backwards and upwards, forms about half of all the cases of dislocation at this joint; it is usually produced by a fall or blow upon the outside of the thigh, with the leg extremely adducted, or from a crushing weight received when in a stooping posture. It is to be recognized by the flexed position of the thigh, the knee, when the patient stands, projecting in front of but above the other; the rotation inwards of the limb, the great toe resting on the instep of the opposite foot; the projection of the great trochanter and its approximation to the anterior superior spinous process of the ilium; the elevation of the fold of the buttock; the immobility of the limb, and the pain produced by any attempt to abduct or extend it; and the marked shortening of the limb from one inch and a half to two and a half inches (Fig. 339).

In thin subjects the head of the bone may be felt lying upon the dorsum; in all there will be an unnatural fullness at this part.

FIG. 339.



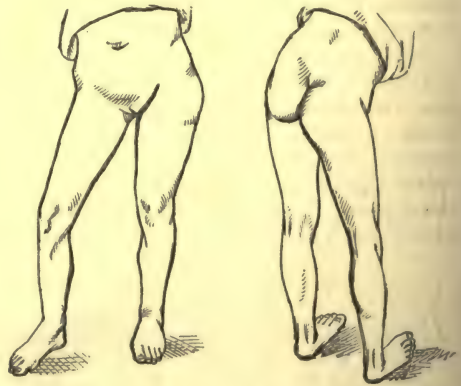
Drawing 30°. Dislocation backwards on the dorsum.

FIG. 340.



Dislocation on to the sciatic notch. From Bigelow.

FIG. 341.



Dislocation in the foramen ovale. Taken from a girl set. 14.

Slight flexion and adduction will usually be borne, and patients may support the weight of the body on the injured limb, or even walk upon it.

Dislocation backwards on to the ischiatic notch forms about a seventh of all cases, and may be regarded as a variety of the one just described; indeed, Erichsen describes the two forms together as the ilio-sciatic. It is characterized by the same but less marked symptoms. There is less shortening, less flexion and adduction, the trochanter is drawn up and rotated outwards, but not to the same extent; the head of the bone is not to be felt. To the eye the limb assumes much the same position as in the last form, but there being less shortening the toe rests on the ball of the great toe of the opposite limb instead of on the instep (Fig. 340). Bigelow believes

that this form of dislocation is due to the protrusion of the head of the bone below the tendon* of the obturator internus muscle; whereas in the former kind the bone is above the tendon. In this opinion I believe him to be right (Fig. 338).

Dislocation upon the foramen ovale or obturator foramen is a very striking accident. Sédillot believes, with Boyer, that it is the most common of all forms, but British and American surgeons usually place it third on the list. In my own table it stands second. It is generally caused by some forced abduction of the knee or foot, the head of the bone being tilted inwards. In the case from which Fig. 341 was taken, it was caused by abduction of the knee when the girl (æ. 14) was stepping out of an omnibus.

It is characterized by the bent position of the body, and the pointing of the foot forwards and slightly outwards; the approximation of the trochanter towards the mesial line, and consequent flattening of the hip; hollowness below the antero-superior spinous process of the ilium; the absence of the gluteal fold, and the elongation of the limb for about two inches. Any attempt at movement causes pain. The head of the bone can often be felt in its new position beneath the adductors (Fig. 342). The patient can however at times walk with such an injury.

Dislocation upon the os pubis is the least common form of dislocation; it is due to forced extension of the thigh, the pelvis being thrown forwards and the body bent backwards, the head of the femur being wrenched out of the socket and drawn outwards.

It is marked by eversion of the limb and foot with abduction; rotation inwards of the trochanter, and consequent flattening of this region. The head of the bone can also usually be felt, if not seen, as a projection upon the os pubis (Fig. 343) or on some part of the lip of the acetabulum. When thrown above the bone, beneath Poupart's ligament, it forms a very prominent projection beneath or to the outer side of the femoral artery (Fig. 344).

When the head of the bone is thrown between the anterior superior and inferior spines of the ilium, or between the inferior spine and the acetabulum, the head of the bone will be felt in that position.

Diagnosis.—With reasonable care these dislocations ought to be readily made out, although certain fractures about the neck of the femur may present symptoms somewhat like them. I have seen two cases of impacted fracture of the neck of the thigh bone, with the foot inverted and the thigh flexed, presenting symptoms so similar to those of dislocation on to the sciatic notch, that the diagnosis could not be made out till the patients were brought under

FIG. 342.



Dislocation into foramen ovale.

FIG. 343.



Dislocation upon the os pubis.

From Bigelow.

FIG. 344.



From Astley Cooper.

the influence of chloroform, when by gentle manipulation the nature of the accident was discovered; the greater freedom with which the head of the bone could be made to rotate in the acetabulum, and the limp condition of the limb under chloroform in the case of fracture, forming a marked contrast to the immobility and permanent position of the thigh in dislocation. Mr. R. W. Smith (on "Fracture," 1850) records also a case of fracture of the neck of the femur which had been mistaken for dislocation.

When in the adult the displacement recurs after the apparent reduction of the bone, and the extending force has been removed, the probabilities are that the lip of the acetabulum has been broken off, or the head of the femur fractured (*vide* Birkett, "Med.-Chir. Trans.," vol. 52); when in the child, a displacement of the head of the bone or upper epiphysis should be suspected; it being quite impossible, under both these circumstances, to maintain the bone in position, except by means of a long splint or weight to keep up extension. In all cases of a doubtful nature the surgeon should give chloroform for purposes of diagnosis, using, however, the gentlest manipulation. The sudden loss of mobility, the rigidity of the limb, the absence of crepitus, and other symptoms of fracture, with the positive signs of the injuries themselves, are, however, sufficient to indicate the nature of the case.

Nélaton's test for dislocation of the hip, pathological or accidental, demands a notice, for it is an excellent one. By it any dislocation can be made out, the test being a line drawn from the anterior superior spinous process of the ilium to the most prominent part of the tuberosity of the ischium. In a normal joint the trochanter, in every position of the limb, just touches the lower border of this line; in most dislocations, and in all those where the bone goes backwards, it is found above it, sometimes an inch.

TREATMENT.—Sir A. Cooper and surgeons of his day used to look upon the muscles as the chief agents in drawing a displaced bone into its abnormal position, and also as forming the main obstacle to its reduction. They consequently looked to physical force as the chief means by which this obstacle was to be neutralized, and employed pulleys and other complicated appliances to overcome the difficulty. The modern surgeon, with chloroform in his hands, knows that the muscular system has little or nothing to do with the difficulties that are met with in the reduction of a dislocation, these difficulties being found in the ligaments and capsule, a large laceration in the latter allowing easy reduction, when with a small one difficulties may be experienced, the head of the bone being held as a button in a button-hole. With chloroform, therefore, all pulleys and mechanical appliances are done away with—in recent cases certainly, in old cases probably. In my own opinion they are never required, for adhesions are more readily broken down by manipulation, forced flexion, extension, and rotation than by simple extension, and if these means fail, no extending force will succeed. In dislocations of the hip the reduction by manipulation becomes, therefore, a reality, and is one of the greatest improvements in modern surgery.

In the dislocations backwards, *ilio-sciatic*, the reduction by flexion, adduction, circumflexion, abduction, and extension, is probably the best, as it is the most successful (Fig. 346), and in dislocation into the foramen ovale, the reduction by flexion, circumflexion inwards, and extension (Fig. 345), is to be recommended.

In subpubic dislocations the reduction by extension outwards and rotation is preferable.

Professor Busch, in an admirable paper ("Syd. Soc.," 1863) formulated

the reduction of dislocation of the femur as follows: In *dislocation on to the dorsum and sciatic notch*, flex the thigh to rather more than a right angle, adduct it till the knee reaches somewhat over the opposite side of the body, and then rotate outwards. In *dislocation forwards* on to the pubes or foramen ovale, abduct the thigh, rotate it somewhat outwards, and carry it into hyperextension, then rapidly rotate inwards, and place it straight.

This description I adopt as my own, preferring to reduce the dislocation into the foramen ovale by the flexion plan rather than by extension.

To carry out this reduction by flexion and manipulation, the patient should be placed on the back on a hard couch and thoroughly anæsthetized. The surgeon should then grasp the ankle of the displaced limb with one hand and the knee with the other, flexing the leg upon the thigh and the thigh upon the pelvis, at the same time adducting the limb towards the opposite side of the umbilicus. Having effected this movement, the surgeon should, by a semicircular sweep outwards, bring the limb into a right angle with the body, and suddenly extend it in a straight line (Fig. 346). Should one attempt fail, a second may be made, and in by far the majority of recent cases success will attend the effort. No roughness should be used, gentle, well-directed manipulation being all that is called for, the leverage obtained through the femur being enormous. Some slight rotation of the limb outwards or inwards, according to the necessities of the case, at times facilitates reduction. If these manœuvres are examined by the help of the skeleton, writes Callender ("Lancet," 1868), "it will be found by flexion, and by moving the thigh into a straight line with the body, the head is brought from the ischiatic notch into the groove just above the outer side of the tuber ischii. Here it is opposite the least prominent part

FIG. 345.



FIG. 346.



Reduction by manipulation.

In dislocation upon the foramen ovale.
From Bigelow.

In ilio-sciatic dislocation.

of the lower edge of the acetabulum, and if the femur is depressed whilst in this position, the head easily slips into the socket." Callender insists, and I think wisely, upon the importance of *not fully abducting* or rolling the limb outwards, for if this is done, the head of the bone is almost certain to roll past the acetabulum to its inner side; or if an obturator dislocation is under treatment, and the thigh is rotated inwards, the head of the femur will roll round to the ischiatic notch, just reversing the movement which takes place when an ischiatic dislocation is improperly manipulated.

The object of the treatment is to use the femur as a lever to raise the

head of the bone from its position, and allow the stretched muscles to act naturally and draw it into place, the surgeon, with his knowledge of the way in which the head of the bone was driven through its capsule, using his best endeavors to make it retrace its steps, and employing his anatomical knowledge to press, elevate, or guide the malplaced bone into its normal position. This plan of reduction in America is known as Reed's. In a case of dislocation into the foramen ovale in a man, I failed in my first attempt by manipulation, but in the second I succeeded by the application of the slightest pressure upon the head of the bone; and in the case of the girl from whom Fig. 341 was taken the head of the bone slipped into its position by simply flexing the leg on the thigh and the thigh on the pelvis, on such gentle pressure as I was applying for a preliminary diagnosis.

In one case of severe injury to the joint, where the bone was displaced on to the dorsum, on attempting its reduction by manipulation the head of the bone slipped with such facility round the acetabulum as to illustrate every typical form of dislocation, and several intermediate or partial forms; and to make the illustrations complete I caused the bone to be thrown forwards on to the pubes. Reduction was subsequently readily obtained by manipulation after more thoroughly flexing the thigh upon the pelvis, and then raising the head of the femur by extension forwards from its false position.

When the rent in the capsule is small, difficulties may be felt in reducing the dislocation. When large, little is usually experienced.

At times reduction is thought to have been accomplished when redislocation appears after the limb has been left alone; and, under these circumstances, it is probable that the head of the bone had only partially been replaced through the rent in the capsule. In other cases of this kind which refuse to remain *in situ*, there is reason to believe that the lip of the acetabulum has been fractured, or, in young subjects, that the head of the femur has separated at the epiphysial line of junction with the neck. Still, without these explanations, cases are met with in which it is quite impossible to keep the limb in position after its reduction. In exceptional cases the reduction of the dislocation occurs when the patient is in bed, by some simple movement. I have seen several such. When reduction by manipulation has failed, or is inapplicable, that by extension should be employed, and in the pubic form of dislocation no other should be used. It should be practiced as follows, with the patient under the influence of an anæsthetic, and on his back: The pelvis should be fixed by a perineal band well padded and adjusted, and the limb extended in the line of its position to draw the head of the bone out of its bed. The surgeon should then either elevate the bone to allow the muscles to act upon it, or abduct, adduct, or rotate inward or outwards, according to the special want of the individual case. In some cases the simple extension of the limb with the unbooted heel of the surgeon placed firmly in the perineum will answer every purpose.

After the reduction of a dislocation the legs should be fastened together, and no movement allowed for three weeks, and then gentle movement only, for if this rule be not attended to, redislocation may occur. In a case under my care of dislocation into the foramen ovale after reduction had been effected in a young woman, redislocation occurred on the tenth day in an attempt to cut the toenails of the affected limb by crossing the leg across the opposite knee.

Splints are hardly called for in the majority of cases, although should secondary inflammation follow, or much local mischief complicate the

case, they should be applied, either with ice, or hot fomentations, the surgeon selecting the application that gives most relief.

Old dislocations, in a general sense, should be left alone, for in the hip difficulties of reduction are always felt, and danger not rarely met with. During the first three weeks reduction is rarely difficult, and may always be tried; indeed, within the month good hopes attend the attempt. Fergusson states that after three weeks he has never seen a successful attempt. I have seen a dislocation on the dorsum reduced on the thirty-fifth day with an excellent effect, but after that date have not known of any good result. Success has, however, been recorded in exceptional cases up to the sixth or eighth week, or even after six months, but failure has more frequently followed the attempt. Sir A. Cooper fixed eight weeks as the limit of time up to which the attempt should be made. When reduction has failed, good movement may often be secured after the lapse of time. The dangers attending attempts at reduction are not theoretical. Inflammation and destruction of the joint is no unfrequent consequence, and fracture of the bone has been recorded by many surgeons. Dislocation of the knee or rupture of its ligaments has likewise taken place from the extension employed with a fatal result.

When fracture of the femur is associated with *dislocation of the bone*, the latter should be reduced by manipulation when possible. In 1860 I saw my colleague, Mr. Birkett, reduce with the greatest facility a dislocation of the head of the femur on the ramus of the pubes in a boy æt. 12, when the femur was broken below the trochanters, the bone slipping into place on the application of gentle, well-directed force. Similar cases have been recorded by Bloxam and M. Etène.

When the reduction of the dislocation by these means has failed, some hope remains that when the fracture has united a better success may be secured, Sir A. Cooper having related an example in which reduction was effected five weeks after the accident in a youth about seventeen, by means of extension.

Effects of Dislocation.—At times in a dislocation of the hip the sciatic nerve may be injured, and as a consequence paralysis may ensue. MacLise in his illustrations gives a drawing showing how the nerve may be stretched, and Hutchinson ("Med. Times," 1866) gives a case in which the paralysis was permanent.

Dislocations of the Patella.—These are not common accidents; they are generally caused by muscular action, but at times by the application of a direct force. They are met with most commonly *outward*, occasionally *inwards*, very rarely *edgeways*. When the ligamentum patellæ has been torn across, the patella is drawn upwards, and authors have described this accident as *dislocation upwards*.

The dislocation *outwards* is usually seen in women in whom the femora have a more oblique inward direction than in most men, or in knock-kneed subjects, the bone resting on the outer condyle of the femur or its outer edge; in the former case the outer edge of the patella tilts forwards, in the latter the inner. The knee is usually slightly flexed; it looks broader and flatter, but the unnatural position of the cap marks the nature of the accident. In 1868 I saw this accident in a male child ten months old; the patella rested on the outer side of the condyle of the femur; it was readily reduced.

Dislocation *inwards* is very rare, and is always due to direct violence to the outer border of the bone; it is easily recognized.

Both these accidents are attended with laceration of the synovial capsule.

TREATMENT.—Reduction is usually readily effected by raising the heel

of the limb to relax the extensor muscles of the thigh, and manipulating the displaced bone into its position, the elevation of its depressed edge being generally enough to allow the muscles to restore it to its right place. A splint should then be applied, and a bag of ice ordered for a few days, till all inflammatory action has subsided, the knee being strapped up for a month or more subsequently, to give time for the ligaments to unite firmly. These dislocations are, however, very prone to recur on the slightest cause, and many patients are obliged to wear subsequently a firm leather knee-cap to guard against such a contingency.

Dislocation of the bone *edgeways* is a very uncommon accident. I have seen but one such instance; in it the patella appeared to show its articular facet inwards, its inner edge presenting forwards beneath the stretched skin. It was in a middle-aged woman, and was produced by a direct blow upon the knee from a fall off a chair. Mayo has recorded an instance in which the bone had turned almost round.

This dislocation is readily known by the peculiar aspect of the joint.

TREATMENT.—In my own case reduction was effected with ease on raising the leg and turning the patella into its right position with the fingers. Flower succeeded only on bending the knee after chloroform had been given. Cases have been recorded where reduction was impossible, even after the subcutaneous division of the tendon and ligament that is attached to it, and other rough means, but these were employed before chloroform was introduced, and this must be their excuse. Under an anæsthetic it is probable that by manipulation the bone will usually be reduced, if not, it had better be left alone. Some sudden muscular effort might be of use.

Dislocation of the Knee-joint.—This accident can only occur from great violence, the ligaments that bind the bones together being very strong; it does occur, however, the tibia being displaced *backwards, forwards, or laterally*. These dislocations are found to every degree of completeness; when *partial*, no complication, as a rule, exists, the lateral is usually of this nature; when *complete*, the soft parts about the joint and fibrous tissues within are often so injured as to render it a great question whether the joint, or even the limb, can be saved. The back and forward dislocation are usually of this kind. When the popliteal artery or vein is injured or ruptured amputation of the limb may be called for, this necessity being rendered more than probable when the circulation through the vessels is not speedily restored after the reduction of the dislocation, or a swollen condition of the limb remains. These dislocations are readily diagnosed by the peculiar deformity they display, and they are easily reduced, extension and the application of pressure, where pressure is needed, being all that is required.

After the parts have been replaced in their normal position, splints should be adjusted and cold applied, for secondary inflammation is almost sure to follow.

Compound dislocations of the knee are generally so serious as to necessitate the removal of the joint; the attempt to save it should only be made in exceptional cases; amputation or excision may be selected.

Dislocation of the head of the fibula is occasionally met with. I have seen but three examples, one when dressing for the late Mr. Aston Key, and two since. It is generally caused by some violent adduction of the foot with abduction of the knee, the head of the fibula tearing through its ligamentous attachments and becoming displaced outwards. The accident is readily recognized by the projection of the bone. It is to be treated by the application of a pad and pressure over the part, sufficient to keep the bone in its place, the limb being flexed when necessary to relax the biceps femoris. The pressure should be maintained for at least two months if good

success is to be looked for; as a rule, the bone never quite reassumes its former position, the head projecting more than usual. This deformity, however, does not appear to weaken the limb to any great extent.

Dislocation of the interarticular fibro-cartilages (semilunar) is a recognized accident. It is produced by some sudden twist of the knee with the foot everted, and generally in subjects who have relaxed joints, or in such joints as have been the seat of some chronic synovitis. The inner cartilage seems more liable to displacement than the outer. The symptoms of the accident are well marked; a patient when walking accidentally catches his foot against a stone, or in rising from a kneeling position is seized with a sudden sharp sickening pain in the knee. The joint becomes at once fixed in a semiflexed position, and any attempt to move it excites some pain; when the first agony has subsided, a painful spot is usually left, and if the internal derangement of the joint, as they originally called it, is left untreated, synovitis or effusion into the joint will soon show itself. When these symptoms follow such an accident as has been described the cartilage has probably been torn from its attachment to the tibia and been doubled in or displaced, the condyles of the femur and the head of the tibia coming directly into contact.

TREATMENT.—The best practice consists in the forced flexion of the joint, the slight rotation of the leg outwards, and sudden extension. When success attends this manœuvre, the joint moves smoothly and without pain, and the patient will at once be able to move the joint freely. At times the reduction of the displaced cartilage is attended with a decided snap. After its reduction the joint should be kept in a splint, and such means employed as the symptoms that follow indicate, for more or less inflammation often ensues, requiring ice, cold lotions, leeching, and rest. When these have subsided also it is well to restrain the movements of the joint by means of a knee-cap or strapping, as a recurrence of the accident is prone to follow upon the least occasion. I have on several occasions thought that disease has been excited when this measure has been omitted, and I once saw ankylosis follow. Permanent lameness is by no means uncommon. When the surgeon fails to reduce the displaced cartilage, the patient at times suddenly gains relief by its self-reduction during some accidental movement; the patient should, therefore, be kept in bed, and only allowed to move the limb, but not stand upon it. When this result is not secured the joint should be strapped up to restrain movement.

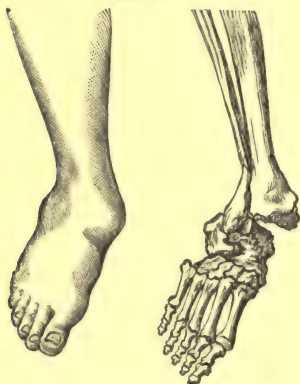
Dislocations of the Ankle-joint.—Such an accident uncomplicated with fracture is rare—that is, dislocation of the foot *outwards* is generally associated with fracture of the fibula; and dislocation *inwards*, with fracture of the tibia; or both malleoli may be broken. Pure dislocations of the foot *forwards* or *backwards* may, however, occur. These dislocations are given in the order of their frequency. They are usually produced by some violent twist or bending of the foot, when the patient is jumping, or by some violent impulse of the body, with the foot fixed.

Dislocations of the foot *outwards* is better known as *Pott's fracture* (Fig. 347), the fibula being usually broken two or three inches above the external malleolus. It is caused by a violent bending of the foot outwards, with the foot everted, its outer edge being raised and the inner turned downwards on the ground. At times the extremity of the inner malleolus is broken off, and displaced outwards, with the foot and astragalus. Under all circumstances the lower end of the tibia, or inner malleolus, forms a prominent projection inwards, leading or misleading Sir A. Cooper and his copyists to describe this accident as dislocation of the tibia inwards. At the seat of fracture of the fibula a depression exists. When the force is continued

beyond the point necessary to cause the displacement mentioned, the lower end of the tibia may be made to project through the soft parts, and thus give rise to a *compound dislocation*. In still more severe cases the extremities of both tibia and fibula may be made to project, the foot being completely turned outwards. Exceptional cases occur in which the foot is turned out of its socket, between the malleoli, without any accompanying fracture.

Dislocation of the foot *inwards* (Fig. 348) is the counterpart of the last-described accident; it is caused by violence that turns the foot inwards, with its outer edge to the ground; it is usually associated with an oblique fracture of the inner malleolus and displacement. The force required to produce this dislocation is very great, the tibia being a far stronger bone than the fibula; it is, consequently, less common. The end of the fibula is often fractured, and drawn outwards with the astragalus. At times the

FIG. 347.



Taken from Pott's work.

FIG. 348.

A. P. Cooper.
Dislocated foot inwards with
fracture of inner malleolus.

FIG. 349.

Dislocation of the foot backwards.
Cast 165. Guy's Mus.

astragalus is fractured as well. The accident is known by the inversion of the foot, the sole looking inwards, and by the projection of the external malleolus, this prominent symptom having led Sir A. Cooper to describe it as dislocation of the tibia outwards.

When the force is continued or more severe the fibula may be made to project through an external wound; and in still more severe cases, the fractured or rather exposed ends of both tibia and fibula. I have seen this take place more than once; and in one case a sound recovery ensued, with a movable joint; it was, however, in a boy, æt. 12. I simply reduced the dislocation after washing the wound, and fixed it in splints.

Dislocation of the foot *backwards* (Fig. 349). Cooper called this dislocation of the tibia and fibula forwards. It is usually caused by the violent propulsion of the lower end of the leg bones forwards, with the foot fixed; it is readily recognized by the shortening of the anterior surface of the foot, and a proportionate elongation of the heel, with some pointing of the toes, and prominence of the lower end of the tibia. At times the fibula is fractured, and the point of bone carried backwards with the astragalus.

This accident is a rare one, it being more common to meet with fracture of both malleoli, and displacement of the foot and broken fragments backwards.

In 1862 I was called to treat a very marked case of this kind in a man

æt. 32. The astragalus with the foot seemed to have been shot completely out of its socket, and the extremities of the tibia and fibula projected so far forwards as almost to rupture the soft parts covering them in. The accident was caused by wrestling. The dislocation was reduced by flexing the leg on the thigh and by manipulation; but no means could be found to maintain the bones in position till the tendo Achillis was divided and the leg placed on its side and fixed on an outside splint.

Mr. Cock ("Guy's Rep.," 1855) has recorded a case of the same accident in a boy, æt. 16, where the same difficulty was experienced. He divided the tendo Achillis and bound the foot in splints; a good result was obtained.

Dislocation of the foot forwards is probably more rare than the last; it is generally only partial; it has been described as dislocation of the tibia backwards; it is known by precisely the opposite symptoms to those last described. The heel is shortened and the foot lengthened, the upper surface of the astragalus being capable of recognition by the fingers. Poland records such a case ("Guy's Rep.," 1855), in which the whole foot was much elongated, and the posterior part of the astragalus was caught in the anterior part of the tibia and fibula, and wedged in tightly. Reduction was only effected after the division of the tendo Achillis.

TREATMENT.—The lateral displacements of the foot are not difficult of reduction by extension and well-directed manipulative force; the knee, being partially bent, facilitates this operation by relaxing the muscles of the calf.

To keep the bones in position, a Macintyre or flat posterior splint, extending up to the popliteal space, with foot-piece and two side-splints, all well padded, are, as a rule, sufficient, the surgeon using his judgment as to the amount of pressure and padding that may be demanded. In some cases, where it is a very difficult matter to keep the parts quiet from the action of the gastrocnemii muscles, the tendo Achillis should be divided, the foot being, after this simple operation, perfectly passive, and entirely in the hands of the surgeon to place and to keep in any required position.

The limb should subsequently be slung in a proper swing, Salter's being the best. In hospital practice two or more pieces of bandage slinging the splints to the cradle answer well. In the displacement of the foot forward or backward the same kind of treatment is applicable; but in these accidents it is, as a rule, expedient to divide the tendon at once. At any rate this should be done when the slightest disposition to displacement is found to exist, the treatment of the case being by this operation rendered more simple and certain.

The splints should be kept on for at least six weeks, and after that date passive movement allowed. The patient should not, however, bear any weight on the limb for another month.

The treatment of *compound dislocation of the ankle-joint* cannot be reduced to any definite rules. Each case must be treated on its own merits. In young and healthy subjects more may be attempted in the way of saving the joint than in the old or cachectic. When a small wound exists, operative interference is only exceptionally needed; but when a large one, with projection of the bones, it is a question whether the better practice lies in the reduction of the dislocation after cleansing the projecting bones, or in their resection. When the bones cannot be reduced by ordinary force, their resection becomes a necessity. When the bones are much crushed their resection should always be undertaken; indeed, it is a general feeling in my own mind that in compound dislocations, as in compound fractures with a large wound, it is wiser to resect the ends of the projecting bones

than to reduce them. Amputation of the foot should only be performed when the soft parts and bones are much injured, and the age of the patient or his power forbids the hope of a recovery with a useful limb being secured. Before any attempt at reduction is made the parts should be thoroughly cleansed. After the reduction of the dislocation, whether simple or compound, the application of ice in a bag is of great value, or the treatment by irrigation. In the suppurative stage the latter practice is probably the better of the two. When the wound is only of a limited nature, it may be sealed at once either by lint soaked in blood, or by, what is better, the compound tincture of benzoin. Carbolic acid dissolved in oil is now a favorite dressing, and may be used. Report speaks strongly in favor of washing out the joint in such cases with a weak solution of this acid (1 part in 40), and then sealing the wound. Opposite the wound an interrupted splint should be employed.

Secondary amputation may be called for in these cases, on account of gangrene or a failure in nature's efforts to effect repair, &c., &c.

Dislocation of the tibia and fibula at their lower articulation, with a forcing of the astragalus upwards between the two bones, is an accident which must be recognized (Fig. 350). It is usually produced by a jump from a height on to the foot or feet. I saw this once, in 1869, in a man, æt. 55, who fell off a scaffold, and in both feet the same result took place. The malleoli were widely separated and projected, the depth of the foot from the extremities of the malleoli was lessened, and the movements of the foot almost gone. No fracture could be made out. It was impossible to move the bones from the position in which they were wedged, although all means were used. A good recovery, however, took place, but with stiff joints. Sir W. Fergusson describes this accident and gives a case.

Dislocations at the tarsal joints are met with in practice, although but rarely; they are difficult to diagnose, and still more to classify, for they are so variously described by different writers.

The first I shall notice is the *dislocation of the foot from the astragalus*, this bone maintaining its normal position between the malleoli. The possibility of such an accident was doubted, till Mr. Pollock, in 1859 ("Med-Chir. Trans.," vol. xlii), published two cases: in one of these, which occurred in Mr. Keate's practice in 1823, the os calcis and scaphoid, with the other foot-bones, were displaced *outwards* off the astragalus, and in the other the same bones were dislocated *inwards*; *dissection* of this case, which occurred in his own practice, is given. In the former instance, the foot was everted and the head of the astragalus projected on the inner side of the instep; in the latter, the foot was inverted, as in varus, so that the sole turned inwards; the external malleolus was very prominent, and the astragalus projected on the outer side. In some instances the surfaces of the foot are maintained in their right line. In Mr. Pollock's case reduction was found to be impossible till the tendo Achillis had been divided, when it was readily accomplished; and in an able paper he advocates this practice whenever difficulty of reduction is experienced, whether of the inward or outward dislocation, simple or compound, the division of the posterior tibial tendon being, at times, called for in the outward. In this recommendation he followed Mr. Turner, of Manchester, who advocated the

FIG. 350



Dislocation of ankle.
Astragalus between
tibia and fibula. Cast
160. Guy's Mus.

same practice ("Trans. Prov. Med. and Surg. Assoc.," vol. ix). Macdonnell, of Dublin ("Dub. Journ.," 1839), published a case in which the same bones were displaced *backwards*, in which the heel projected, and a marked prominence existed on the dorsum of the foot, with an abrupt descent in front on to the tarsus; and M. Parise ("Annales de la Chirurg.," 1845) has given an instance, which is apparently unique, of dislocation *forwards*, in which the projection of the heel was effaced, and marked elongation of the foot existed.

All these tarsal dislocations are rare. I have seen but one example, a case recorded by Mr. Cock, in the "Guy's Hosp. Rep." for 1855, of dislocation inwards, with a drawing; but in my work on the "Joints," 1859, I published (Case 85) an example of dislocation of the foot outwards, with a description of the dissected extremity, which had occurred in the practice of Mr. Aston Key, in 1845. The foot was amputated, reduction having been impossible. The ankle-joint was perfect. The calcis, with the foot, were displaced outwards. The tendon of the tibialis posticus was found in front of the tibia, holding down the astragalus. The posterior tibial nerve was violently stretched over the astragalus. The limb was removed for tetanus, the symptoms immediately disappearing after the amputation. A large number of these cases are compound; in some they are complicated with fracture of the fibula. Broca ("Mém. de la Société de Chirurg.," tome iii), out of 13 examples of dislocation outwards, gives 9 as compound.

This dislocation may be diagnosed from displacement at the ankle-joint and dislocation of the astragalus itself, by the fact that extension and flexion are present; from fractures about the ankle, by the absence of crepitus, together with the positive signs of the injuries themselves.

TREATMENT.—Reduction should only be attempted with the patient anæstheticized, and under such an influence by extension and manipulation it would probably be accomplished. When difficulties are experienced Turner's and Pollock's suggestion of dividing the tendo Achillis should be followed, and even of the posterior tibial tendon when it is clearly interfering with the replacement of the bones, or of any other tendon that is acting the same part. When these means fail, and the stretched skin gives way, the case must be treated as one of a compound nature and the astragalus excised, the foot being subsequently well confined in splints and ice applied. At times amputation may be demanded, or Syme's or Pirogoff's more partial operation.

Dislocations of the astragalus alone are probably more common than the former accident. I have seen several such, but only one of the sub-astragaloid or last described variety; Pollock, however, believes the pure dislocation of the astragalus to be very rare.

The bone may be shot out of its socket forwards and backwards and even laterally, and in rarer examples rotated on its axis.

In the dislocation *forwards* the head of the bone projects from between the malleoli; in some cases being shot inwards so as to form a marked eminence beneath the internal malleolus, in other cases outwards. In such an accident the heel remains in its normal position, and all movement of the ankle-joint is lost.

The dislocation *backwards*, of which Phillips ("Med. Gaz.," 1834) and Turner have cited examples, is indicated by the remarkable projection which suddenly appears above the heel, pressing out the tendo Achillis, the shortening of the foot, and the prominence of the tibia in front.

Dislocation of the *astragalus laterally* to be complete must be compound (Fig. 351), and when incomplete at first will probably become complete at

a later period through sloughing of the soft parts. It is generally complicated with fracture of one or other of the malleoli, but not always. Boyer has recorded a case of dislocation of the astragalus *inwards* in which no such complication existed, and in the "Guy's Reports," for 1862, I recorded an example of dislocation of the bones *outward*, in a man, æt. 51, in which both malleoli were entire, the astragalus having been fractured and turned completely out of its bed, being found hanging to the wound below the external

FIG. 351.



malleolus. I removed the broken fragments at once, and brought the foot into a good position; a complete recovery with a stiff joint ensued. At the present date, eleven years after the accident, the man walks about without the aid of a stick, with no other inconvenience than that occasioned by a stiff joint, which he maintains in very slight.

Some rotation of the bone often coexists. Fig. 352 illustrates a case of dislocation of the bones outwards, complicated with fracture of the fibula.

TREATMENT.—In the simple dislocation of the astragalus when the bone can be replaced by manipulation, nothing more is needed; but such a result cannot always be secured; when it cannot, even under chloroform, the tendo Achillis should be divided. In 1862 I was called to see a man, æt. 28, who fell four yards on to his feet; the astragalus of the right foot was shot forward completely out of its socket, and nearly burst through the skin. Chloroform had been given, and every form of manipulation and extension employed by competent men to reduce the bone without effect. I divided the tendo Achillis, extended the foot fully, and applied gentle pressure to the projecting astragalus, the bone slipping back readily into its place. Some crepitus was, however, felt, and I believe some horizontal fracture of the astragalus existed, the upper surface and head having been displaced forwards; the foot was fixed on side-splints, and a good recovery ensued with a movable joint.

FIG. 352.



Dislocation of the astragalus outwards, and fracture of the fibula. Cast 161.

When the bone cannot be replaced it is not quite a settled question whether the bone should be removed at once, or only after the tissues have sloughed. Sir A.

Cooper strongly advocated the latter practice, and Broca has since supported him, showing by an analysis of cases that in 36 examples of irreducible simple luxation in which the bone was removed at once, one-fourth were fatal; while in 43 in which the bone was left alone, only 2 deaths took place, in 2 amputation was performed, in 16 the bone was removed after sloughing, and all recovered, in 23 no operation was called for, recovery taking place with a useful limb.

In all compound dislocations of the astragalus the removal of the bone should always be effected.

Dislocations of the other tarsal bones have been recorded; thus Malgaigne relates two cases of *dislocation of the calcis* outwards, the bone forming a projection beneath the external malleolus and beyond the cuboid articulation. In 1865 I saw a case at Guy's, admitted under the care of Mr.

Birkett, in which the left *scaphoid bone* was displaced inwards, forming a very marked projection. Under chloroform it was readily reduced by pressure, at a moment when the distal end of the foot was drawn outwards.

I have the notes also of a case of dislocation of the internal cuneiform bone upwards, with the metatarsal bone of the great toe, in a man *æt.* 24; of a second, in a man *æt.* 30, in which the same bones were displaced inwards, an accident produced by a weight falling on the outer ankle when the foot was resting on the great toe. In both cases reduction was readily effected with a good result.

Holthouse tells us that the internal cuneiform bone may be separated from all its articulations, and thrown upwards and inwards. The three cuneiform bones are also sometimes luxated together upwards; they may be reduced by pressure without much difficulty.

The *scaphoid* and *cuboid* bones may also be displaced. Malgaigne has described this accident as a middle tarsal dislocation; Liston has described it in his "Practical Surgery;" and Sir A. Cooper in his work "On Dislocations."

Dislocations of the *metatarsal bones* may likewise occur. In 1854 I saw a case recorded by Mr. Cock ("Guy's Rep.," 1855), in which the entire metatarsus appeared to have been separated from its attachment to the cuneiform and cuboid bones, and thrown on to the dorsal surface of the instep, where their bases could be seen and felt. The internal cuneiform and navicular bones appeared to have been likewise injured. The injury was the result of a crush from the wheel of a railway wagon. All Mr. Cock's efforts at reduction failed, but a good foot was secured, the man subsequently having returned to his work as a laborer on the railway.

Dr. Hetzig ("Syden. Soc. Bien. Ret.," 1865-6), who gives us an analysis of 29 cases of these tarso-metatarsal dislocations, states that 13 were of single bones, 16 of the entire metatarsus, some of these being lateral, others vertical, as in Cock's case. In the former the greater inconvenience follows from a failure in reduction.

Dislocations of the phalanges are less common than those of the finger; they mostly occur upwards from direct violence to the ends of the toes, and, as a rule, are compound. The great toe is the one usually injured, and, as in the thumb, considerable difficulty is at times met with in its reduction, the ligaments and many tendons around the joint affording an explanation of this fact. They are to be treated in the same way as the thumb. Reduction should always be effected when possible by extension and well-directed pressure, forced flexion or extension at times facilitating the process.

CHAPTER LXXII.

PATHOLOGY OF JOINT DISEASES.

To assert that a safe and scientific surgery can only be based on a sound pathology may appear to be a somewhat trite observation; nevertheless, it is a true one, and so true is it that it cannot be impressed too forcibly on all who seek or profess to practice our profession. It should, moreover, be the aim of every surgeon whose duty it is to practice and to teach, to demonstrate the truth of the assertion, and to establish his practice upon such a scientific basis.

It is with this feeling that I now propose to consider the pathology of joint disease, to explain briefly the changes the tissues undergo during inflammation, and the results to which those changes lead, for by so doing I shall render my subsequent remarks on the clinical affections of the individual joints more intelligible, and shall be able to connect symptoms with pathological conditions.

In these observations I shall be as brief as the subject will allow, and as concise as will be consistent with clearness; my aim being to connect the clinical symptoms of joint disease with its pathology, and to make the scientific illustrate the practical. Putting aside for the present disputed points of pathology, and for future consideration the subject of tumors involving joints, it may, in all truth, be stated that diseases of a joint generally commence in one of two tissues, the osseous or the synovial, and that either an acute or a chronic inflammation of the bone or synovial membrane is the origin of most. It is true that in the progress of any case both tissues may become eventually involved, and when disorganization of a joint has taken place, both bone and synovial membrane will be necessarily affected; but the extent to which either tissue will be involved will depend greatly upon the seat of the original disease. When it begins in the synovial membrane and disorganization of the joint follows, the articular cartilages may disappear, and the bones may be involved, but the disease will, in all probability, affect only their articular facets with the parts immediately beneath—it will rarely involve the deeper parts; but when the bones are the original seat of the mischief, and the inflammatory process has spread from these to the synovial membrane, and disorganization of the joint has taken place, the chief pathological changes will be seen in the osseous tissue, and will involve either the whole or a part of the articular epiphysis, if not a portion of the shaft. In short, when disease commences in the synovial membrane and disorganization of the joint follows, it is in that tissue the greatest change will be seen; and when it originates in the bones, it is there that the greatest pathological changes are to be witnessed. Under both circumstances the cartilage covering the articular facets will have disappeared, although in the affection of the bones the cartilages are shed more rapidly, for the articular cartilages derive most, if not all, of their nourishment through the bones; and, as a consequence, any perversion of nutrition and inflammatory changes of the bones at once show themselves in the cartilages.

Practically, there is no such thing as a primary disease of the articular cartilages—no such thing as so-called ulceration of cartilage independent of disease of other tissues. When the cartilages undergo a change, that change is always secondary to some other affection; either of the synovial membrane, when it is slow and partial in its action; or of the bone, when it is rapid and complete. It should, however, be remembered that disease in the synovial membrane of a joint cannot exist for any period, or be of any severity, without involving the ligaments with which it is connected, or the cellular tissue with which it is surrounded. Nor can inflammatory disease exist for any time in the articular extremities of a bone without affecting more or less the periosteal membrane with which it is so intimately associated. Nevertheless, I believe that clinically it is important to bear in mind the distinct origin of the disease in one or other tissue, and that a correct treatment must rest upon our diagnosis.

Before proceeding to consider the changes the different tissues undergo from the inflammatory process, it will be well to ask the question, with a view to its solution, whether there be such a disease as strumous disease of a joint—strumous disease of the synovial membrane or of the bone.

If we were to answer this question according to custom, as indicated by

the free application of the term to joint disease, I should unquestionably say that it was a common affection, for there are few chronic changes of a joint that are not so designated; indeed, it is rare to meet with any chronic affection of a joint in a delicate child which is not regarded by some as a strumous disease. I have often thought that the constant use of the phrase would lead any one to believe that the term strumous disease had some definite meaning, that it conveyed some definite idea from the mind of its employer to those who heard it, that the affection so designated was of a special kind, and was to be recognized by special features, and that it possessed definite pathological characteristics. Yet it can hardly be said that such is practically the case; for, if we look for the points of difference between the so-called strumous disease and the chronic inflammatory affection we shall fail to find them. They are not clinically to be distinguished. They are not practically to be separated. Indeed, I am more than satisfied that the so-called strumous disease of a joint is nothing more than a chronic inflammation of the bones or synovial membrane, or both; that the pathological changes in the affected tissues are such as are clearly traceable to a low form of inflammatory action, and that they differ in no single pathological point from the inflammatory changes found in other parts. It is true that such affections are of a low type, and in that respect they differ from other inflammatory actions of a more healthy character, but that they are nevertheless inflammatory there can be no doubt. Practically, therefore, it would be well to expunge this term, "strumous," in respect of joints, from our vocabulary; for its use certainly misleads, by making the student believe that the term has a definite meaning when it has not; and by encouraging the idea that the disease to which it is applied has more a constitutional than a local origin, and is consequently incurable. Of this, however, I am quite sure, that so-called strumous disease of a joint is, as a rule, as curable as any other affection; that it is as amenable to treatment as any other chronic inflammatory disease. In saying this, however, I do not dispute the fact that, pathologically, we do at rare intervals find tubercular deposit in some of the tissues building up a joint. When present it is generally found in the bone; but I must repeat again, what I wrote ten years ago in my work on diseases of the joints, that such preparations are to be regarded as pathological curiosities—they are so rare. They are discovered also accidentally, and are not clinically to be recognized by any characteristic features from other cases of chronic inflammation of the bone. It would be well, therefore, to give the term up in scientific discussion, or, if it be used at all, to use it in the same broad sense as the words tumors, rheumatism, and fever are now employed, as a broad general term that includes many affections and covers much ignorance.

With these general remarks we will now pass on to consider the changes the different tissues entering into the formation of a joint undergo in the inflammatory process. We will first of all take the synovial membrane, and at the end of the section pause to consider the clinical symptoms which may be taken to indicate the pathological changes. The pathological changes in the articular cartilage, ligaments, and bones, will occupy our attention in their turn.

On the Pathological Changes which take place in the Synovial Membrane from Inflammation.—In a pathological point of view, inflammation of the synovial membrane may show itself in two distinct ways—firstly, in change of function, and secondly, in change of structure. The first change may take place without the second, but the change of structure necessarily includes an alteration in the function. We see this in every-day practice, for in the ordinary run of cases of so-called chronic or subacute synovitis,

excess of secretion in a joint is the main symptom, and this secretion may be reabsorbed and leave no trace of disease behind. These cases may be regarded as examples of the first class of cases, in which a change of function is the most prominent point. As illustrations of the second class, in which change of structure is the main point of clinical as well as of pathological importance, the pulpy disease of the synovial membrane naturally presents itself. Between the two great classes of cases, however, there are doubtless many links—for example, in acute synovitis we have change of structure even to disorganization more or less complete, and in chronic synovitis frequently repeated, we have change of structure such as gradually passes into the pulpy synovial disease; this term including all the cases of pulpy or gelatinous disease of the synovial membrane. It would thus appear that in acute inflammation of the synovial membrane we have pathologically a series of changes that are somewhat different from those seen in a chronic inflammation, and in a clinical point of view the same distinction is to be drawn. The acute form passes, it is true, into the chronic by imperceptible gradations, but the two classes of cases are, nevertheless, very distinct. Let us consider what these changes are, and first of all with respect to acute inflammations. Now acute inflammation of a synovial membrane is clinically represented by increase of secretion, severe local pain, and heat, with symptoms of surgical fever. Pathologically it is represented by what my notes of cases clearly illustrate,—a more or less minute injection of the capillary vessels, passing on to a velvety appearance of the synovial surface, a flocculent surface, or one covered with fimbriated fringes of lymph. In the still more acute cases the synovial membrane may have disappeared by ulceration or sloughing, or have so softened down as to be destructible on the slightest touch. In such cases as these acute suppurations of the joint will probably be present, and the synovial membrane may show any one of the conditions already indicated, or it may have disappeared, pus and broken-up membrane alone remaining to indicate the local severity and the destructive nature of the affection.

In less acute cases other changes may be seen, and they are not less marked. In one instance, the notes of which are before me, a local patch of capillary injection appeared—an injection which was visible to the eye, and which was attended with a superficial granular change of structure in the cartilage with which it was connected. In another it showed itself by the effusion of a firm fibrinous layer of lymph over the surface of the synovial membrane and articular cartilage. This membrane could be raised from its bed and peeled off—not only off the synovial capsule, but also off the articular cartilage—and beneath this membrane fine radiating capillary vessels were clearly visible, passing from the margin of the articular cartilage towards the centre. In this case, after a section was made through the spot of injected membrane and cartilage down to the bone, the swollen layer of membrane passing over the cartilage was clearly visible, as well as the granular degeneration of the cartilage beneath; and this membrane could be separated from its cartilaginous connection by means of needles.

This case occurred in a child, but it seems to me to be enough to prove by means of pathology what anatomy has hitherto failed to settle,—that a layer of membrane passes over the articular cartilage. I have seen these changes more than once.

The changes that take place in the synovial membrane in subacute and chronic synovitis remain now to be noticed. They are essentially of the same pathological character as are those we have just been considering, but they differ in this great point,—that the synovial membrane is not destroyed, but becomes changed. It becomes thickened in various degrees by the infiltra-

tion of inflammatory product within its walls and upon its surface. This thickening may be so great that the synovial membrane may be represented by a tissue an inch in diameter; but this will only be found in cases in which repeated attacks of inflammation have taken place, and many layers of lymph have been deposited upon and in the affected tissue. These layers may not be deposited rapidly one after another by consecutive attacks of chronic inflammatory action, for they may be the result of disease which has spread over many years, but they will always represent an inflammatory action of a chronic nature which has at uncertain intervals attacked the joint, and on each occasion left behind it pathological evidence of its presence by an inflammatory infiltration.

It is with such changes as these that all cases of the gelatiniform or gelatinous disease of the synovial membrane, as well as the pulpy disease of Sir B. Brodie, are unquestionably to be classed. Both are of the same nature pathologically and clinically—at least, all my own investigations have led me to this conclusion. Twelve years ago, when writing upon the point, I suggested that such might be the case, but did not feel sufficiently certain to assert it. All experience since then has, however, led me to the conclusion, and I know of nothing that militates against the idea. In the present papers I shall therefore employ the word pulpy disease of the synovial membrane to designate the changes which ensue in chronic inflammatory synovial disease. It is short and as expressive as any other. It is likewise a term with which the profession is familiar.

The Clinical Features by which these Pathological Changes may be recognized.—It will have been remarked that, in all the pathological changes we have been describing, excess of secretion, or effusion into the joint and synovial membrane, invariably occurred. It may, moreover, have been observed that these changes were the earliest, or, at any rate, were very early, results of the inflammatory action. Clinically, therefore, the most marked symptom that characterizes synovitis in any of its forms is enlargement of the joint, either from effusion into the articulation, thickening of the synovial membrane itself, or both conditions combined. In the superficial joints, such as the knee, elbow, ankle, wrist, all these changes are readily to be seen, and when seen, are readily recognized. In the deeper joints they are also present, and are to be made out on a careful clinical examination.

This is the main point I would wish to be remembered in connection with this subject.

On the Pathological Changes the Articular Cartilages undergo from Disease.—The most important point the practical surgeon has to recognize when considering the pathology of the articular cartilages has reference to the fact that there is no primary disease of this structure, for pathological anatomy teaches us that all the changes that are to be found in it are secondary to some other affection, and in the generality of cases to disease in the articular extremities of the bones. There is no such thing, therefore, as primary "ulceration of the cartilages," and when the cartilages are diseased they are so from the extension of mischief from the bone beneath or from the synovial membrane about them.

Much has been written about diseases of the cartilages, under the idea that they were liable to special diseases; and much error in joint pathology has crept in as a result. The authority of great names, such as Brodie, Key, and others, has helped to encourage this idea. But modern investigation, as carried out by Redfern, Goodsir, and others, has corrected this erroneous notion, and an improved pathology has clearly shown that the diseases of the cartilages are due to diseases of other tissues.

When describing the results of my own investigations ten years ago, I divided these affections into the fatty, the fibrous, and the granular degenerations, and nothing that has been observed since has led me to doubt the accuracy of this division; indeed, additional experience has confirmed me in its truth. I am not about to enter, however, in this place into a minute description of these different changes, for they are to be read elsewhere; but it will suffice for my present purpose to remind my readers that the fatty degeneration of the articular cartilages is found in joints that have been deprived of their natural functions from any cause—from non-use in the majority of cases, but in many from bad nutrition—that it is found in common with the same change in the bones or other tissues. This fatty degeneration is to be recognized with tolerable facility by the naked eye, for the cartilage, instead of possessing its natural white pearly aspect, will appear somewhat transparent; its surface will probably present an undulating, unequal, although smooth, surface; it will, when cut, feel softer than usual, and may be three or four times its natural thickness. At times it may even be “pulped” by firm pressure with the finger, and it may be separated from the bone with more than usual facility. Microscopically it will present also characteristic features. The natural cartilage-corpuscles will have become changed into fat and granule-cells in various degrees; the hyaline matrix will be filled with cavities, varying from the healthy standard to large cells. These cells will be filled with more or less of the elements of fatty degeneration, in which the healthy corpuscles will have changed into fat-cells, and the hyaline matrix will have changed more or less into an irregular cellular fatty matrix. This fatty degeneration takes place in most joints that have not been used, but rarely from disease of the joint itself. When present in a joint that becomes the subject of inflammation, disorganization of the articulation rapidly follows, for such a lowly organized degenerated tissue has no power of resisting disease, and when brought into contact with it rapidly disappears.

The Fibrous Degeneration of the Articular Cartilage is a disease of a peculiar character. I believe it to be associated with only one disease of a joint, and that is the so-called “chronic rheumatic arthritis.” It is very gradual in its progress, and is not characterized by any definite symptoms. It is to be recognized pathologically in a joint in its earliest stage by the loss of the natural glistening aspect of the cartilage, the smooth surface of which disappears, and it looks rough. Small fissures next appear, involving more or less of its thickness, and sometimes these extend down to the bone. These fissures are, as a rule, thicker in the centre, and at times radiate outwards; the cartilage seems gradually to become thin, and after a time to disappear, exposing the articular surface of the bone, which will probably have undergone the calcareous degeneration. Microscopically, the chief change that is seen in this disease is the gradual alteration of the hyaline structure into fibre. The cartilage-corpuscles at the first are found interspersed between these fibres, but at a later date these corpuscles will be seen to have changed into granules. At the last stage nothing but fibres may be found, and when this condition exists, the rapid disappearance of the structure altogether will not be far distant.

The Granular Degeneration of the Articular Cartilage is the most important affection of this tissue we have to study. It is the one most commonly found in joint affection, and seems to be the direct consequence of a perverted nutrition in the bone or synovial membrane, the result of disease in one or both of these structures. Although of a simple nature, it shows itself in many ways, and without microscopical investigation must have appeared unintelligible. In its different forms it has doubtless led good

observers to describe it as an ulceration of cartilage, for under certain conditions the cartilage presents a worm-eaten excavated appearance, not unlike that which ulceration might produce.

The disease is essentially a granular degeneration, first of the natural cartilage-cells which are imbedded in the hyaline matrix, and, secondly, of the hyaline matrix itself. Let a cartilage-cell undergo this granular degeneration, and the granules by accumulation and multiplication form a cavity in the hyaline matrix; then let this cavity burst on the surface of the cartilage into the joint, and an excavation which can be seen by the naked eye becomes at once visible, and a so-called ulcer is produced. Let this change take place towards the margins of the articular cartilage, and we find an explanation of Mr. Key's observations upon so-called ulceration of this tissue in certain forms of inflammation of the synovial membrane of the joint. Let this change take place near the bones as a result of disease in the epiphyses, and we find an explanation of the general condition of the cartilages in the bulk of joint diseases; for when the bones entering into the formation of a joint are so affected as to interfere with the nutrition of the articular cartilages, the cartilage may easily present the worm-eaten appearance all over or in part, or it may have been shed from its bony attachment, when it will be found to be lying upon the bone as a foreign body in the joint. In an early stage of disease this granular degeneration may only be detected by a microscopical examination, although, when it follows upon disease of the bone, the cartilage will always be found to peel off its articular facet with unusual facility.

In synovitis also the surface of the cartilage in contact with the inflamed membrane will be found similarly involved. Should the disease be local, as is at times seen in cases of injury to an internal ligament, such as the ligamentum teres, the change in the cartilage will be local only, but when general, the whole surface of the cartilage may be involved. In acute disease acute degeneration follows, as is evidenced by daily practice.

On the Pathological Changes in the Bones the Result of Inflammation.—Inflammation of the articular extremities of a bone is a very common disease; it is probably the most common we have to deal with in connection with joints, for it would appear to be the cause of most, if not all, of those cases of disease of the articulations which we find in children, and which have been described as strumous or scrofulous disease of a joint. Ten years ago, when describing the results of my investigation into this affection, I stated that "I cannot for one moment doubt that the majority of the cases which are described by surgeons as strumous or scrofulous disease of a joint and of the articular extremities of the bones depend upon a chronic inflammation in the bone," and all the experience I have gained since has tended to confirm me in this opinion. I believed then, as I believe now, that the disease is in its origin and progress inflammatory, and that it is as curable as any other local affection. I am convinced that the presence of tubercular deposit in the bone is a very rare occurrence, and that, when present, it alters but little the natural progress of the disease, although it may render the case less amenable to treatment. It is important to bear this truth, if such it may be called, invariably in mind when examining or treating a case of disease of a joint, particularly when it is found in a so-called strumous or cachectic subject, for if we regard the disease as a constitutional one we are too apt to think it is to be treated on general principles and to neglect the local means by which alone a good recovery is to be secured. For my own part I would abolish the term strumous disease of a joint altogether. It is based on a wrong pathology, and unquestionably suggests an imperfect treatment. Let the surgeon

recognize the true inflammatory nature of the disease, and be convinced of its curability by local and general treatment. He will then surely be more successful in his practice, and better results by treatment on the expectant principle will unquestionably be obtained.

Let us now, then, proceed to inquire into the changes that the bone undergoes during this inflammatory or wrongly called strumous affection.

The most striking is probably the earliest, and that is the expansion of the articular extremity. In some cases the enlargement will be very great, and it is generally uniform. The articular extremity of the bone affected, and, indeed, the epiphyses of all the bones entering into the formation of the joint, will appear to be rounded and generally enlarged. Upon making a section of a bone thus affected it will be found softer than natural; it may probably be so soft as to allow a knife to divide it. It may even break or crush on firm pressure being made upon it. To the eye the section will appear more vascular than natural, the cancellated portions more cancellated, the cells enlarged, and the bony septa to radiate from the shaft in a broad, palm-like fashion. The cells also will be found filled with a pinkish serum.

Should the disease continue, and the inflammation be of healthy type, parts of the bone will appear denser and more indurated than the remainder. The cancelli will have been filled with inflammatory product that has organized, and will appear on section as a dense and apparently bloodless mass, surrounded by other vascular cancellated tissue. Should the inflammation be of an unhealthy character, diffused suppuration within the bone will take place, and death of the bone, wholly or in part, follow.

Under these circumstances, the disease will probably have become a genuine joint affection—that is, it will have extended to the synovial membrane of the joint, and have set up disease within its substance. This extension of disease will show itself by effusion within the joint, and by pulpy thickening of the synovial membrane and of the cellular tissue around the articulation. Up to this point the disease has been a local one, involving only the articular extremities of the bones, and has not attacked the proper joint structures; it appears also to be perfectly curable. But at this stage of the disease the articular cartilages will probably become affected; for

when the inflammatory action has continued for any period, and has not shown any indications of subsidence, but, on the contrary, has either assumed an unhealthy character, or has interfered with the nutrition of the articular lamella of bone upon which the cartilages rest, the articular cartilage will to a certainty undergo a granular degeneration upon the surface in apposition with the bone, it will become loosened from its attachment, and be thrown off or shed (Fig. 353), or it may degenerate in patches and present to the eye an irregular excavated surface. If the disease be slow, the cartilage will degenerate slowly, and be as slowly loosened from its osseous base. It will then be readily lifted off the bone by any instrument. If the disease be more rapid, the cartilage will be shed likewise more rapidly, when it will be found lying upon the bone as a foreign body in irregular patches, which, under the microscope, will appear to have undergone the granular degeneration.

FIG. 353.



Drawing (G. M. 3030^b), made to show the shedding of the articular cartilage in ostitis.

When the disease is acute the cartilage may disappear altogether, having been shed from its osseous base and become rapidly degenerated.

The articulating surface of the bone during this time may appear in some cases only extra-vascular, as in inflammation; in others it may be rough, or, so-called, ulcerating; in a third class the articulating facets will have been shed wholly or in part. In another class, pieces of necrosed bone involving more or less of the articular extremity of the bone will be seen. In another, an abscess will have made its way into the joint from the diseased articular extremity. But in all these conditions the cartilages will have disappeared and the joint become disorganized.

These pathological remarks are applicable to every articulation, to the hip as much as to the knee, and to the shoulder as to the elbow.

The symptoms they give rise to in each joint are only such as the formation and surroundings of the joint produce, but in their general character they are the same, swelling from effusion and thickening of the soft parts in synovial disease being the most marked symptoms; and long-continued aching or so-called growing pains, followed by expansion of bone, in bone disease.

I propose, however, to enter a little more fully into hip-joint disease, so as to make the subject more clear, and to prove the points I have laid down.

CHAPTER LXXIII.

DISEASES OF SPECIAL JOINTS.

Disease of the Hip-joint.—That disease of the hip-joint differs in no single pathological point from disease of any other articulation is the most important point a surgeon can have before him when commencing the consideration of this subject: authors have hitherto been too much disposed to lead their readers to look upon *morbus coxæ* as a special or peculiar affection, and to believe that it is both pathologically and clinically distinct from the diseases of other joints.

It has also with too much confidence been described as a “strumous disease,” as if all diseases of the hip-joint or of any joint are generally of this nature, or are found only in subjects of a strumous diathesis; as if all have a constitutional, and not a local, origin.

To look upon hip-joint disease as a strumous affection is unquestionably wrong, pathologically as well as clinically. It is found in the so-called strumous subjects as frequently as, but not more frequently than, any other affection. It is always a local disease, and is too frequently set up by local causes. Moreover, it is as amenable to local treatment as any other local affection. It is not, in the true sense of the word, a constitutional disease, and the sooner that idea is got rid of the better it will be for the profession as well as for our patients. “The affection occurs very frequently in strumous children,” says a recent able author (Mr. Holmes), “a circumstance which has led to its being denominated ‘strumous,’ but it seems to have no necessary connection with struma, unless so wide a signification be assigned to that somewhat vague term as would render the designation itself unmeaning. If by struma be meant a state of the system which renders the subject of it prone to the deposit of tubercle in the viscera, I think that there is good reason for asserting that *morbus coxarius* often attacks chil-

dren who are not strumous—i. e., who display no such tendency to the deposit of tubercle—and therefore that no decisive proof of any strumous tendency is afforded by the presence of the affection. If, on the contrary, struma be defined as that condition of the system which disposes its subjects to the development of low inflammations of various kinds, then it is difficult to see what is the significance of the designation.” With these remarks I cordially agree. It would, therefore, be well to get rid of the erroneous notion that hip disease, as has been already said of joint disease in general, has its origin in a constitutional cause, for till that is effected the local treatment is likely to be disregarded, or only regarded as being of secondary importance, when all who have much experience in the treatment of these cases will admit that local treatment cannot be made too prominent a feature.

Hip disease should therefore clinically be looked upon as a local affection, and be treated principally by local means, such constitutional treatment being employed as the general condition of the patient may appear to warrant; and the same principles of practice are in these cases applicable as are found of value in the treatment of any other joint affection.

Hip disease is unfortunately a very common affection. My own statistics tell me that it forms about 30 per cent. of the joint cases admitted into a metropolitan hospital. It is also an affection of child life, for out of 360 cases, of which I have notes, 62 per cent., or nearly two-thirds, occurred in children under ten years of age, and four-fifths in patients under twenty—that is, it occurred during the growth and development of the bone, and not during the period of its full maturity. This point will be seen on reference to the following table:

Table showing the ages at which hip disease commenced.

Four years and under,	126 cases	} 223 cases, or 61.9 per cent.
Between 6 and 10 years of age,	97 “	
“ 11 “ 20 “	86 “	} or 23.8 per cent.
“ 21 “ 30 “	27 “	
“ 31 “ 40 “	13 “	} or 7.5 “
Above 40 years of age,	11 “	
		or 3 “

230 of these cases were collected by me when acting as registrar to Guy's from 1853 to 1861; 130 are from the notes of cases which have been under my own care.

Hip disease is found in equal proportion in the male and the female subject. But it seems to attack the left limb more frequently than the right, 60 per cent. of my cases having occurred on the left side, and 40 on the right. This proportion is very similar to that published by Mr. Lonsdale in the “*Lancet*” for September 8th, 1855, where out of 112 cases of deformity of the hip, 65 were of the left side and 47 of the right.

With these preliminary remarks we will now proceed to consider briefly the pathology of the disease.

Pathology of Hip Disease.—It has been already stated that in a pathological point of view hip disease differs in no single respect from that of other joints, and that it is not a strumous affection, although it may occur in strumous subjects. It may be said also—as it has been said before—that it is a very rare thing to find strumous or tubercular matter in a diseased joint, and the hip-joint forms no exception to this rule. Disease of the hip-joint means, therefore, excluding new growths involving the part, inflammation of the bones or soft parts entering into the articulation.

Few points in the pathology of joints have been more disputed probably

than the seat of the disease in hip-joint affection; but, I take it, the difficulty, has been entirely raised upon the mistaken notion that it had a special origin, and that the nature of the affection was different from other joint diseases. We have never heard much importance placed upon the point in diseases of the knee, shoulder, or other joints. The question has never been very warmly discussed as to the origin or not of disease of the knee in the crucial ligaments, or of disease of the shoulder in the long tendon of the biceps. And yet we find men, good men and true, gravely discussing the question as to the origin of hip disease in the ligamentum teres. My late respected teacher, Mr. Aston Key, laid great stress upon this point, and believed that it was from that ligament and its attachments that disease of the hip-joint generally proceeded. Pathology has, however, made great advances since those days, and we now know that disease in a joint (hip or other) may have its origin in the bones which form the joint or in the soft parts or ligaments that hold them together. Experience has told us that we may have an acute inflammation of the synovial membrane of the hip-joint rapidly going on to complete disorganization of the ligaments, cartilages, and soft parts of the joint, and even causing death of the bones entering into its formation. The inflammation may be so acute as to render it difficult at the post-mortem examination of such a case to read the pathological facts correctly, for when such changes take place as have just been indicated, it is fairly open to question whether the inflammation originated in the synovial membrane, and from such a centre spread to the bones, cartilages, and ligaments, causing their destruction; or whether they began in an osseous centre and extended to the joint. In some cases the disease may have been so severe as to cause a separation of the pelvic bones into their original segments, or a dislocation of the epiphysis of bone forming the head of the femur from its normal attachment to the neck.

Under all these circumstances, the ligaments and soft parts, with the articular cartilage, will have been completely destroyed, and the exact locality in which the disease originated will be difficult to make out. When we find all the bones of the joint equally involved in such acute disease, it is probable that the disease began in the synovial membranes and spread to bone in the same way as we meet with diseases of bone as a result of acute periostitis. But when we find one bone more diseased than another, *e. g.*, the femur than the acetabulum, or *vice versâ*, it is probable that acute inflammation originated in it and spread to the soft parts. These points, indeed, are to be looked upon as only feeble indications upon which an opinion may be formed, and not as definite guides. Nevertheless, they are based on observations of cases. In chronic disease of the hip-joint, however, the question as to the seat of the original disease is not so easily answered, and yet, from what I have observed clinically and pathologically, I do not put the question down as being one which it is impossible to answer. It may be difficult, in some cases it may be impossible; but, in the majority, I believe an opinion can be formed by a careful attention to clinical facts and pathological conditions.

When we find a joint disorganized, with its ligaments and cartilages gone and the articular surfaces of the bones exposed, and perhaps diseased, there may be some difficulty in deciding as to the particular tissue in which the inflammation originated; but when a section of the bone is made—the head of a femur, the head of a tibia, or any other bone—and a cavity is found communicating with the joint, or a sequestrum of necrosed bone, or a suppurating bone, probabilities certainly point to the bone as being the original seat of the disease.

These cases do occur, and they are far from uncommon. I have the notes

of many such now before me, and the different museums contain many specimens. But it may be said that no one doubts the cause of the joint disease in such instances, and that the pathological conditions found to exist clearly prove it; yet the clinical histories of such cases differ in no single point from the clinical histories of others in which, perhaps, the same very marked evidence of disease is not to be seen, that is, if the joint be examined on its surface only. Indeed, to examine a pathological specimen of a bone or of a diseased joint, it is absolutely necessary to make a vertical section through the bone; to look at it from the joint surface is most fallacious, and an opinion formed from the appearance thus acquired is too likely to be wrong.

If we make, then, a section of the bone, we shall in a large number of cases of disease of the joint, particularly in the young subject, find hyperæmia of the articular extremity of the bone, condensation from chronic inflammatory action of the bone, if not suppuration or necrosis (Fig. 354); in fact, marked evidence of articular osteitis in one of its stages, for this is in my experience the most common form of disease which precedes joint mischief, and from which joint disease proceeds in the great bulk of cases during young life. This opinion is also well supported by the fact that in our museums almost every specimen of chronic joint disease reveals extensive bone mischief, extending beyond the surface, and generally involving more or less of the articular ends of the bone entering into the formation of the joint. In our own hospital museum this point is very strongly displayed, and on looking over other museums and very extensive notes of joint cases the same truth comes out very clearly. At times the disease may primarily commence in the epiphysial cartilage, situated between the head of the femur and its neck, the epiphysis being thrown off, as seen in Fig. 355.

FIG. 354.



Necrosis of the head of the femur,
with sequestrum in its neck.
Prep. 1318⁵, Guy's Hosp. Mus.

FIG. 355.



From preparation 1315²⁰. Separation of
head of femur.

This pathological observation must be looked upon as being one of great clinical importance, for if the majority of cases of joint disease are to be attributed to the extension of inflammatory action from the articular extremity of a bone to the other tissues, it becomes a question of great urgency to recognize the disease of the bone in its early stage, and thus, if possible, to prevent its progress to the true joint, that is, to the tissues upon which the integrity of the joint itself depends; and clinically there is good reason to believe that such can frequently be done. In the hip-joint this point may be a difficult one to settle; that is, it is more difficult than it is in disease of other articulations, such as the knee, that are not so well covered in

with soft parts. Nevertheless, even in the hip it is to be made out by care and discrimination. And perhaps it may be well to consider here the clinical features upon which our diagnosis is to be determined. They are not numerous.

The first clinical point to which I propose to draw attention has reference to synovitis; for inflammation of this membrane, of whatever kind, always shows itself within a few hours or days of its origin by effusion, and consequently by distension of the articulation. In the knee, ankle, elbow, wrist, shoulder, and other joints, this clinical condition, as a rule, makes itself manifest in a way which cannot be misinterpreted. The synovial sac becomes enlarged and distended by the effusion, so that it bulges between the bones and gives an outline to the joint, which is unlike that furnished by any other condition. In the hip-joint similar changes take place, but they are not quite so palpable; they can be made out by a careful examination, and particularly by a comparison of the affected with the sound side, a point of practice which should never be omitted in the examination of any injured or diseased joint. The soft parts in front of the joint will in synovial mischief be more prominent and full; pain will be produced by gentle pressure made upon the part, particularly behind the great trochanter; a soft swelling will also exist in lieu of the natural depression; and to the eye a greater fulness will be visible. Even fluctuation may be detected through the joint on careful palpation. At any rate, to the eye and hand there will be clearly some extra fulness of the soft parts, enough to lead one to suspect the true nature of the disease. This fulness or swelling is always an early symptom of the disease, for in a clinical point of view synovitis is in its earliest state indicated by enlargement of the affected joint.

In disease of the articular extremities of the bones a different clinical condition will be found to exist. At the commencement of the disease, and sometimes for a lengthened period, which varies in each case, an aching of the part is the only local symptom. This aching may be of greater or less intensity, the pain depending much on the severity of the disease. It is too often looked upon as "growing pains" or as rheumatism. But what I wish now to note is that local pain is the first clinical symptom, and not effusion; there is no enlargement of the affected joint. As the disease progresses, an enlargement may be detected. It may in the hip be made out by manipulation; in the knee or other joints it may be visible to the eye. It will, however, be an enlargement clearly of the bone, a thickening or expansion of the osseous structure unlike that existing in synovial disease. There will be no fluctuation, no soft yielding of the parts, but clearly an expansion of the osseous structure, an enlargement of the articular extremity of the bone. The soft parts will, as a rule, be quite natural over the enlarged bone. With this aching of the part there will also be increase of heat, this increase of heat being an early symptom. It will not be constant, although tolerably uniformly so; it will be intermittent, and, as a rule, it will show itself as a general periodical flushing of the part.

At this period of disease other symptoms generally exist, which likewise differ in the two great classes of cases.

In chronic synovitis, which leads to joint changes, the joint may probably be moved quietly without exciting pain in the part, and without exciting spasm of the muscles that move the articulation. Pressure upon the part with the fingers will probably excite pain, although moderate pressure of one bone against the other may be made without giving rise to any indications of distress. In diseases of the bone entering into the formation of the joint, these clinical conditions do not all exist. The joint may be

moved quietly, it is true, without exciting pain, but the attempt will, as a rule, excite spasm of one or more of the groups of muscles which move the articulation. Moderate manipulation also will be well borne. Firm pressure upon the bones so as to bring the two articular surfaces in contact will always excite pain—not the pressure produced by a jar, such as in the hip is caused by a sudden blow upon the foot or trochanter, for such a mode of investigation must be looked upon as a rough and somewhat uncertain one; indeed, it is almost sure to excite a start of the patient and an expression of pain—but the pressure which is produced by a steady force applied by the hand to the trochanter towards the pelvis, or through the foot to the articular extremities of the bones, a pressure which, in synovial disease, rarely, if ever, gives rise to pain, but in osteal disease invariably excites it.

These symptoms in the two classes of cases appear clearly to indicate the two distinct affections in their early stage. They apply to all articulations, and may be thus summarized:

In synovial disease swelling is the earliest clinical symptom, with more or less fluctuation, each joint showing this in its own way. As a rule, this swelling is unattended with much pain. Pressure on the joint causes pain, although gentle movement may be made without increasing it or exciting spasm of the muscles which surround the joint. Interarticular pressure can generally be tolerated.

In **articular ostitis** pain is the earliest and most constant symptom—pain of an aching character, varying in intensity, generally increased by firm local pressure. There will be no visible enlargement of the part for some weeks or months, and no fluctuation. Gentle movement, as a rule, excites spasm of muscles about the joint, and interarticular pressure always increases this, and causes pain. Increased heat also exists about the parts, and is of an intermittent character.

When disease can be arrested in these first stages a complete recovery of the patient may ensue, for joint disease has not yet been established, and the cartilages are probably sound, and no irreparable organic change has taken place in any of the tissues.

Should, however, diseased action originate in the joint as the result of accident, in a hip-joint as the result of a strain upon the teres ligament, or in the knee from injury to the crucial ligaments; should local disease be set up from any cause in the articular extremity of a bone, either at the root of attachment of ligaments or at other parts; should articular ostitis of a portion of a bone take place as the result of accident, the changes which a joint may undergo as a secondary consequence will probably be more rapid, and consequently more serious; for it is through the bone that these changes occur by secondary alteration in the articular cartilages, which are so intimately connected with the articular lamella of bone; and in cases of local disease of the articular extremity of the bone, these changes are very rapid. When a bone is inflamed, and this inflammation attacks the articular lamella of bone, wholly or in part, the articular cartilage sooner or later becomes involved. As long as the vascular supply of the bone is good, and the nutrition of the cartilage which rests upon it is not interfered with, all goes on well; but as soon as the nutrition of the bone is impaired, the cartilage on its surface which rests against it undergoes granular degeneration, loses its connection with the bone (Fig. 353), and is either cast off or shed as a foreign body, wholly or in part, or degenerates more slowly, and assumes a perforated, worm-eaten aspect (Fig. 381). It will always, when thus diseased from bone affection, be readily stripped off the bone.

When these changes have taken place in the cartilage to any extent,

disorganization of the joint exists, or is not far off; suppuration, however, may not show itself. A complete recovery of the articulation is probably impossible, and certainly improbable—that is, a recovery, with movement. Ankylosis, more or less complete, must under such circumstances be regarded as a natural cure. A most complete example of this ankylosis is represented in Fig. 356, preparation 1318⁴⁸ in the Guy's Museum. It was taken by my father, the late Mr. T. E. Bryant, from a man æt. 42, who had had a stiff joint for thirty years. In the "Medical Times and Gazette" for 1869, I illustrated all these points fully by a series of cases.

Diagnosis.—The necessity of making a correct and early diagnosis of hip disease is a point that hardly requires illustration, and did not daily experience indicate that it is not sufficiently recognized, there would be no occasion to enforce it.

The early symptoms of the affection are, Synostosis of hip-joint. Guy's Mus. consequently, important.

When a child has received a hurt upon the hip, and this is followed by joint pain, and possibly by limping—these symptoms persisting after all external evidence of injury has passed away—there is some reason to suspect joint mischief; and when, on causing interarticular pressure, either by the pressure of the hand over the trochanter or by the patient standing or walking, this pain is increased, the evidence is stronger. When swelling of the parts can be made out, and some bulging of the synovial membrane is found to exist, as shown by a fulness behind the trochanter and in the groin, combined with tenderness, synovial inflammation is rendered probable; persistent pain, without effusion, aggravated by firm, interarticular pressure, suggesting bone mischief. When these symptoms appear after some fever or illness, or, indeed, without any such cause, they are of no less importance, although, probably, they are more liable to be overlooked.

As a point of primary clinical importance, all joint pain, and particularly hip-joint pain, claims attention. In some cases all the pain is referred to the knee, but this fact must not mislead. *Limping* of any kind is sure to indicate something wrong—probably very wrong—more particularly when combined with joint pain, aggravated by interarticular pressure. *Spasm of the muscles around the joint* is another symptom of significance; in some cases it is so severe as to forbid all movement, in others it is less marked; at times it is confined to one group of muscles, such as the flexors, adductors, or rotators, the position of the limb being much determined by this fact; but, whenever spasm of the muscles about the hip exists, there is probably some affection of the joint itself, or of the bones that enter into its formation. When doubt exists as to muscular spasm being the cause of joint immobility, chloroform should be used, all spasm ceasing under its influence, and the head of the bone rotating by manipulation, with more or less facility and smoothness, according to the amount of joint mischief that is present.

Position of Limb.—In the very early period of hip-joint disease the limb will appear elongated, this symptom being due to a tilting of the pelvis upwards on the sound side, the patient naturally throwing all the weight of the body on to that side, to take off pressure from the affected one; but on

FIG. 356.



measurement, no real lengthening will be found to exist. As the disease progresses, and the spasmodic contraction of all the muscles that move the hip increases in force and intensity, the pelvis on the affected side will be drawn up, and tilted slightly backwards, the thigh becoming flexed upon the pelvis; and this position fairly indicates some confirmed joint mischief, disorganizing changes probably having commenced. In more advanced cases genuine shortening of the limb may take place from real loss of substance in the head or neck of the bone.

In exceptional cases dislocation of the bone will be found to exist, the head of the femur being, as a rule, drawn upwards and backwards (ilio-schiatic). At a still later date spinal deformity may take place; that is when the femur is fixed at an angle with the pelvis, the pelvis becomes tilted forward, to enable the patient to bring the foot down to the ground to support the body. As a compensatory curve the vertebral column arches forwards, giving rise to a remarkable hollow in the back and projection of the abdomen, *lordosis*. On placing the patient on his back, however, and on raising the limb, the spinal curve at once disappears.

Flattening of the nates occurs in hip disease from a wasting of the glutei muscles, from want of use, this symptom becoming more marked when the trochanter is rotated outwards and the foot inwards.

Disease of the Hip-joint, attended with Suppuration.—These are the worst cases of joint disease that come under the surgeon's charge, for supuration of a joint generally means its disorganization, and when the disease has its seat in the bone, necrosis or some less definite inflammatory change. The affection, as a rule, will be found to have been of long standing; the abscess may, or may not, lead direct down to the joint, for in some great burrowing takes place. All free movement of the head of the bone will probably have long disappeared, more or less ankylosis or natural repair having taken place, for in joint affections reparative and diseased actions run much together. The limb will be found in every position, the flexed and adducted position of the thigh being the most common, particularly in neglected cases (Fig. 357). At times, however, the thigh is rotated outwards, and even abducted.

FIG. 357.



From patient—Sarah Barton, æt. 22, July, 1870.

When sinuses exist a probe may detect diseased bone.

When dislocation is present the symptoms will indicate its form, the position of the trochanter above Nélaton's test line readily aiding the surgeon in his conclusion.

All cases, however, of suppuration about a joint, even when associated

with disease of the joint, are not to be regarded as a direct result of disorganization of the articulation; for it is quite certain that inflammatory mischief may exist in the joint, and subside, and yet be followed by suppuration in the cellular tissue about the part; and in this opinion pathological does but confirm clinical observation. There may be some difficulty in making such cases out during life, but I have no doubt as to their existence. In the hip they are the more common.

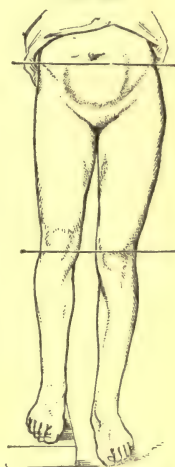
It sometimes happens when articular osteitis has attacked the head and neck of the femur in childhood, and recovery has taken place either with a movable joint or ankylosis, that some arrest of growth in the bone may be the result. I have seen this in a child, who had been under my care when five years of age for articular osteitis, from which she perfectly recovered at the age of eight; at that time the femur was one inch shorter than its fellow, and the trochanter nearer the median line of the body and the antero-superior spinous process of the ilium, the upper end of the femur having clearly been arrested in its growth. (Fig. 358.)

The *diagnosis* of hip disease is to be made after a careful estimation of the value of the symptoms as a whole, and not upon one or more supposed typical symptoms. The limping of a child with infantile paralysis of the leg has been confused with that from disease; the wasting of the limb and the absence of pain ought to prevent such an error. The pain of spinal disease, of psoas abscess, of subiliac abscess, of some glandular affection of the groin, associated with limping, and nerve pain extending down the limb, may mislead; but the knowledge of these facts may prevent the repetition of the mistake.

Disease of the bursa in front of the joint connected with the psoas muscle—which, by the by, at times communicates with the joint—may render the diagnosis difficult, but the pain on pressure in front of the joint which exists in disease of the bursa, and the pain on pressure behind the trochanter in hip disease, is enough to distinguish the two. Disease of the bursa beneath the gluteus maximus muscle also at times may simulate hip affection, but with care the two affections can be made out.

Diseases of the Knee-joint.—This joint is probably more frequently the seat of disease than any other articulation. In hospital practice my own statistics tell me it forms 40 per cent. of the joint cases admitted into Guy's, the greater liability of the knee to injury than any other joint, and the thinness of its natural covering, together, probably, affording the true explanation of this fact; for there is nothing in the formation of the joint itself otherwise to account for it. It is, moreover, met with in patients of a more mature age than hip disease, 62 per cent. of hip cases being found in children under ten, and only 32 of knee disease. It must be admitted, however, when once diseased, the knee is less likely to undergo a natural cure, and much less a cure by ankylosis, than any other articulation, and this clinical truth is probably to be explained anatomically by the existence of the interarticular fibro-cartilages. For although the presence of these cartilages in a healthy joint tends to keep it healthy, in a diseased one their presence forbids the contact of the two bones which is so necessary for ankylosis to take place; these cartilages must consequently be got rid of by some suppuration or other change before ankylosis can be secured.

Fig. 358.



Arrest of growth in femur after articular osteitis.

When diseased, there is also no joint in which the changes can be better recognized—in which the clinical evidence of disease in the synovial membrane or bones can with greater facility be made out.

The effusion into the synovial capsule gives rise to a characteristic swelling, which is quite distinct from that produced by expansion of the articular ends of the bones in articular osteitis; and the thickening of pulpy disease of the synovial membrane presents features which forbid its being mistaken for either of the two other affections.

The enlargement of a joint by long-continued and neglected disease is as difficult to diagnose in the knee as in any other, the main points for guidance being those obtained by the clinical history of the case. In advanced disease, however, this point is happily not one of great importance, more particularly when the joint is disorganized, and the surgeon has to decide as to the expediency of its removal; although when the disease is in the bone the demand for operative interference is greater than when it exists in the softer tissues.

In *synovitis*, acute, subacute, or chronic, the synovial sac becomes distended; the natural dimples or depressions, which in health exist on either side of the patella, soon disappear, and in their places a bulging of the synovial membrane will be both seen and felt. The patella becomes pressed forward, and may be felt on palpation to float as upon a water-bed, being readily made to dip on pressure upon the condyles of the femur which lie beneath. The extensor muscles above the patella will likewise be raised by the distended sac, and the soft parts below the patella, down to its ligament, will project; distinct fluctuation will not only be felt across the joint from side to side, but will be made out as readily in an oblique direction from above downwards. In Fig. 359 some of these points may be seen, but what is felt by manipulation is almost as characteristic.

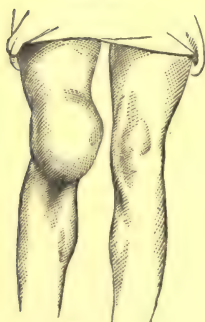


FIG. 359.

Synovitis.

Acute Synovitis of the knee, except as a part of so-called rheumatic fever or pyæmia, is rarely met with, unless the result of a wound or the extension of suppurating disease into the cavity. It is a most severe affection, and unless speedily arrested by ice, leeching, or those means suggested in the chapter on wounds of joints, ends in the destruction of the joint, and too often in the forfeiture of the life of the patient, the constitutional disturbance being very great.

When life is spared after suppuration, and repair goes on, ankylosis may be secured, and in puerperal cases or rheumatic or pyæmic cases this result is not rarely met with, the whole series of changes the joint undergoes being condensed into a few months; but this subject will receive attention in the chapter on the suppuration of joints.

In *subacute synovitis*, a far more common form than the acute, the local symptoms are the same; but the constitutional are far less severe, whether the disease be caused by some local injury or general causes, such as gout, gonorrhœa, rheumatism, or syphilis. It almost always terminates in recovery.

In *chronic synovitis* the same remarks are applicable. This affection is often known as *hydrops articuli*, or simple dropsy of the joint, the chief symptom being an excess of fluid. In many of these cases, however, this effusion into the joint is associated with other changes known to exist in what is now recognized as a special affection—the *chronic rheumatic or osteo-*

arthritis. In this the joint becomes so stretched by the effusion, and the ligaments at last so useless, that the leg may be made to move about in every direction, as a flail. In a large number of these cases, however, plates of bone will be found in the synovial membrane, or about the articular ends of the bones, and bony outgrowths or fringes of ossific matter from the margins of the articular facets, together with other changes, to which attention will be directed in the proper place. It is well, however, to remember here that a large number of the cases of chronic synovitis, or *hydrops articuli*, are really of the peculiar disease known as *rheumatic or osteo-arthritis*.

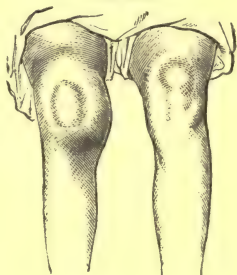
In the *articular ostitis* of the knee-joint the expanded bones are soon made out on comparing the sound with the affected limb, for the articulation thus affected assumes a special shape which is not to be misinterpreted, the condyles of the femur and head of the tibia assuming a globular form, and the soft parts covering in the bones being healthy and movable, and no effusion existing in the joint. (Fig. 360.) At times a joint so affected will increase two inches beyond its fellow; when effusion is present, the extension of the inflammatory action from the bone to the joint itself is indicated, the case being clearly a more severe one.

The condyles of the femur or head of the tibia alone may also be the seat of suppurative disease, of an acute or chronic abscess, these local bone abscesses being probably more common in the head of the tibia than elsewhere. Under these circumstances the enlargement will be confined to the bone affected, until the joint becomes involved, which will be the case when the abscess burrows into it and discharges. This suppuration may occur with or without necrosis. Fig. 370 illustrates a case in which diseased joint followed necrosis.

In the *pulpy disease* of the synovial membrane the local symptoms by which the affection is to be made out are likewise characteristic; neither expanded bones nor dilatation of the synovial sac with fluid is there in typical cases; but the different points of bone, which are always to be made out in a healthy joint, are obscured, if not undistinguishable; they are covered in with a soft solid, not masked with effusion. On palpation a doughy sensation is detected over the articular ends of the bones, and more particularly around the patella. No fluctuation is to be made out, as a rule, and when fluid exists it will clearly be in a thickened capsule. At times this pulpy thickening of the synovial membrane is a secondary affection, due either to some articular ostitis or repeated attacks of synovitis; it is apparently, also, part of a syphilitic disease, the effusion of gummy material around the joint. What Collis described as syphilitic joint, I believe to be of this kind, the pulpy disease, in a syphilitic subject, possibly complicated with periosteal thickening.

Diseases of the Ankle-joint.—Nothing peculiar is to be noticed in the diseases of this joint; their pathology is identical with that of all other joints, synovial mischief being possibly more common than that of bone. Effusion into the joint is readily detected by the swelling and consequent pressing forwards of the extensor muscles of the foot, the fluctuation between the malleoli around, and at times behind, and along the borders of the tendo Achillis. Bone enlargement is readily seen by the expanded

FIG. 360.



Articular ostitis.

malleolus or malleoli. Bone abscess may occur in either malleolus or in the astragalus.

The pulpy disease makes itself known by some such swelling as is found in synovitis, but the swelling will not be due to fluid, but to the presence of the lowly organized tissue found in the disease, showing itself as a doughy swelling around one or both of the malleoli, and beneath the extensor tendons.

Diseases of the tarsal and metatarsal joints, or, rather, of the bones and joints, are very common; for it is in the bones, as a rule, that the disease begins, the joints becoming rapidly involved. In the joint between the astragalus and os calcis, disease, however, may be found alone; and I have often been disposed to think that such disease is commonly the result of some lateral sprain of the ligaments that hold these bones together, lateral sprains of the foot being more likely to be felt at this articulation than at the ankle, the astragalus being held so firmly between the malleoli. Disease in this joint is to be recognized by the seat of the swelling, *beneath* the malleoli, and the pain produced by any lateral movement of the heel or foot, the grating of exposed bone being often detected, the movements of the ankle-joint being at the same time complete.

Disease of the other tarsal or metatarsal bones is indicated by the enlargement of the bone, and the position of the sinuses leading down to them. The scaphoid bone and joints are frequently affected, this bone being the keystone of the antero-posterior arch of the foot; and when the bone becomes affected, the disease very commonly extends to the cuneiform bones, there being but one synovial capsule common to the scaphoid and the three cuneiform bones.

FIG. 361.



The form of the foot thus affected is very peculiar. "It assumes," writes Erichsen, "a remarkable bulbous or clubbed appearance; the fore part and dorsum of the foot are greatly swollen, glazed, and possibly perforated by sinuses discharging thin unhealthy pus." ("Science and Art of Surgery.") When diseased and dead these four bones may be removed, and a good foot left. As a single bone, the cuboid is also not rarely diseased, and may be taken away without any detriment. In the case figured (Fig. 361) the scaphoid, three cuneiform, and cuboid bones were removed, an excellent foot remaining. I removed them from a boy *æt.* 8, simply enucleating the diseased and dead bones from their beds, and disturbing the periosteum and soft parts as little as possible.

Of the **metatarso-phalangeal joints** that of the great toe is the one the most frequently diseased, either from injury or otherwise, and when diseased, it is a troublesome one to deal with. There is some reason to believe that the bursæ about the sesamoid bones at the ball of the toe are sometimes the source of the evil.

When dead bone exists in these joints it may be removed; in some cases the joint may be excised with a good result. I have seen this on several occasions, and in one instance which I operated upon a movable joint was secured. *Gouty* affections of this joint are very common, and may go on to disorganization. Disease of the joint as a result of a neglected bunion is not rare, but such cases will be treated of in another page.

Disease of the sacro-iliac joint is occasionally the result of injury, more frequently following parturition, and at times is the secondary effect of disease of the bones which form the joint. The disease is to be recognized by

pain in the part, aggravated by any position in which by the weight of the body or other act pressure is made upon the inflamed tissues; local tenderness, swelling or suppuration indicate the exact seat. Hilton has, however, in his interesting lectures on Rest, well pointed out how the actual seat of the disease may be masked by the pain being referred to the extremities of the sacral nerves in relation with the joint, *i. e.* to some part of the lower extremity, and how the psoas muscle may be so spasmodically contracted as to produce flexion of the thigh, and thus give rise to the appearances of hip disease or spinal disease.

In the treatment of this affection the same principles are applicable as in other joints—rest, tonics, good food, and air. As soon as suppuration can be made out, an incision should be made to prevent burrowing, which is sure to take place; and when dead bone is present it should be removed. Recently I took away a large piece of bone from this joint in a girl with great benefit.

Disease of the symphysis pubis is very rare. I have seen it but once in a case following what was believed to have been, a fractured pelvis complicated with laceration of the urethra; when I saw the man, months after the accident, sinuses existed running down to the joint and into it, but no dead bone could be felt. In Guy's Museum there is a preparation, 1314⁵⁰, in which the synchondrosis is ossified and carious, with a fistula; and a second, 1314⁴⁰, in which complete ankylosis is present with new bone.

Disease of the coccygeal joint is at least as rare as that of the pubes, although well-marked cases have been recorded; it is readily made out by the thickening over the joint, and the pain produced by any movement in the bone; a distinct grating may also be felt with the finger in the rectum on attempting to move the part.

When the disease is clearly established, and the joint disorganized, the best practice is probably found in the removal of the bone; when this is not advisable, or practicable, the coccygeal muscles had better be divided by a subcutaneous incision to give rest to the joint, but under these circumstances the cure must be slow. The pains of sacro-coccygeal joint disease are much simulated by what Sir J. Simpson described (*"Med. Times,"* 1859) as coccydynia, which is met with in women when any of the coccygeal muscles are brought into action by walking or running, rising, defecating, or sneezing; this is an affection that is to be cured by the subcutaneous section of the coccygeal muscles.

Diseases of the Joints of the Upper Extremity.—Diseases of the *sternoclavicular joint*.—I have seen but two cases which ended in disorganization. Inflammation about the joint in syphilitic subjects, however, is not rare, but such cases rarely break up. The disease is readily recognized, the joint being a superficial one.

Disease between the sternal bones has been recorded by Hilton; I have never seen it. Local pain increased on pressure, and the movement produced on coughing, with swelling, indicate the disease.

Diseases of the Shoulder-joint.—These are comparatively rarely met with; they form a very small proportion of the joint cases admitted into a hospital, the majority of such cases being treated outside. Synovitis, however, in all its forms, is found in this joint, as well as cases of articular ostitis, &c. The joint has no special disease.

When disorganization takes place and suppuration, the matter burrows down the bicipital groove, and, as a rule, makes its appearance in front of the insertion of the deltoid muscle. At times it bursts posteriorly, or burrows beneath the pectoral.

When recovery takes place with ankylosis, a wonderfully useful limb is

often secured, the scapula allowing an amount of movement which is sufficient for most of the duties of life. It rarely, however, admits of any overhanded action. When suppuration takes place from disease at the junction of the upper epiphysis and shaft, the abscess burrows in the same way; and when inflammation of the bursa placed beneath the deltoid muscle exists, some of the symptoms of shoulder-joint disease are present. The fact, however, that the least action of the deltoid muscle excites pain, when the movement of the arm by the surgeon does not, ought to indicate the bursal disease, the joint moving freely, although possibly attended with a sensation of crepitation.

Diseases of the Elbow-joint are of great interest, for the value of the hand is greatly dependent upon its integrity. In their general character they are the same as in any other joint.

Synovitis makes itself known by the general enlargement of the joint, as well as by the sense of fluctuation on either side of the olecranon process. Pulpary disease is recognized by the presence of the doughy, semifluctuating products that have been poured out in the same position. Articular osteitis is also capable of recognition by the expanded bones.

In a general way, elbow-joint cases do well, recovery, with movement, taking place in the majority. In others, a natural cure takes place by ankylosis, and this may follow suppuration or otherwise.

In a large number of cases operative interference is called for, not so much to remove a disease that is incurable by natural processes, as to procure movement and prevent ankylosis, a stiff elbow being often very deleterious. The amount of movement that is at times secured, however, after a natural recovery from a suppurating joint is very good. Fig. 362 was taken from a boy, æt. 19, that had had a disorganized joint treated by free

FIG. 362.



incisions when ten years of age. He had as much movement as the drawing indicates. The head of the radius was displaced outwards. Useful flexion and extension is not only often present, but pronation and supination. In some cases these latter movements are maintained when the ulna and humerus are firmly fixed together. In an old case of my own, seen recently, the rotation of the radius is perfect. In exceptional

instances the head of the radius is displaced outwards.

Disease of the Wrist-joint is not so common as disease of the carpal bones and joints, and when it has started in one part it is very prone to be propagated to others. When suppuration takes place the pus often burrows freely between the tendons, &c. As long as diseased bone does not exist to prevent recovery a good result may be looked for, although probably with some amount of stiffness or even ankylosis. When bone disease keeps up the irritation it may be removed. In all cases to assist recovery the hand should be secured by a splint in the position intermediate between pronation and supination, such a position being the best. The hand, when left alone, is too apt to assume the prone position—a by no means good one.

Diseases of the *phalangeal joints* are, in their nature, like those of other joints and must be dealt with upon similar principles, synovitis, pulpary disease, and bone disease, with or without disorganization, being found in all. By good treatment a recovery with movement may be secured; when a natural cure can only be looked for by ankylosis, as a matter of expediency the question of the removal of the finger may be entertained, for a stiff

joint at the metacarpo-phalangeal joint is a serious detriment; at the middle joint it is less injurious, and, at the last, least so.

In the thumb, amputation is rarely to be thought of; when recovery from disease of the distal phalangeal joint, by ankylosis, is probable, a good thumb may be foretold, but in the metacarpo-phalangeal joint it is so inconvenient that the operation of excision is probably preferable.

The position of the patient, his occupation, age, &c., have so powerful an influence in guiding the surgeon to a decision that every case must be treated on its own merits and according to its own special wants.

CHAPTER LXXIV.

ON THE CURE AND TREATMENT OF JOINT DISEASE.

THE most important truth a surgeon should bear in mind in the treatment of joint disease has reference to its curability, for clinical experience affords convincing evidence that under judicious management a large proportion of joint cases can be guided successfully to a complete recovery; that in some a cure can only take place by ankylosis or a stiff joint; and that it is only in exceptional cases operative interference is really called for.

The recollection of the two former facts is a constant encouragement to the surgeon to persevere with, and to the patient to submit to, the necessary means adapted to secure these ends; whilst it in no way tends to discourage operative interference when the course of the disease, its nature or its severity, gives sufficient evidence that such interference is expedient or necessary.

Pathological evidence likewise carries no less weight towards the support of these conclusions, for no one can have examined with care joints that have been removed either by excision or amputation, with others that have failed to go on towards a successful issue, without having been often struck with the vast amount of repair that has been going on side by side with the disease, with the apparently limited character of the disease, and with the feeling that in many cases some simple operative interference would probably have been successful where a capital one had been performed, or that no operative interference was really called for.

At the same time it must be borne in mind that, although in a pathological sense the disease may have been limited or reparable, and needed no interference, in a clinical sense, a very opposite conclusion may reasonably have been drawn, for by its progressive nature and sapping powers the course of the disease may have proved that, although limited in its own extent, the powers of the patient were incompetent to provide, even in limited disease, the stimulus needed for repair.

In the treatment of joint disease, however, it is not always a question as to the possibility or impossibility of securing a successful issue by simply aiding natural efforts; arguments of expediency come in, and in recent times are gaining in importance. In a large number of cases, however, they do not apply; that is, whenever there is a good prospect of a recovery with a movable joint. They are of great value when brought to bear upon

the question of a cure with a stiff joint, or when a prolonged interval of time must of necessity be required to secure the end.

Those surgeons who look upon a stiff elbow or shoulder-joint as a serious inconvenience, and an unsatisfactory result of treatment, advocate early excision of a joint with the view of obtaining movement that is not always to be secured, and those who have little belief in natural processes guided by art, going on to produce ankylosis in disease of the knee, or think the time spent in the attempt as badly spent, advocate a like practice.

Where some surgeons are always satisfied with a cure of the disease by natural efforts assisted by art, and remove by operative measures joints or parts of joints, as dead bone, only when these natural processes have proved themselves incompetent to effect a cure, others say that in a large number of cases these natural processes lead only to an undesirable end, and that in such it is not expedient to make the attempt.

There is no doubt that in many cases, and in some joint cases, these arguments of expediency are of weight, and are worthy of adoption; but as a broad rule of practice they are dangerous to follow, for natural processes guided by art, in the majority of cases, are followed by results which leave little to be desired, and they are secured without the dangers which are attached to all operative interference. These points, however, will come out better in the consideration of the treatment of individual joints, to which attention will now be drawn.

Treatment of Disease of the Hip-joint.—So long as suppuration or other disorganizing change in the joint has not appeared, a good hope exists of a recovery with a useful joint; and as long as the disease is in the synovial membrane, the probabilities of a recovery, with a movable articulation, are great. When disease originates in the epiphysis—that is, the head of the bone—or in the epiphysal connective cartilage, the prospects of a recovery with movement are slight, unless the mischief is checked in its early stage; for, in the former case, the articular cartilage, deriving its nourishment mainly from the bone, soon undergoes degenerative changes that can only be repaired by processes that end in ankylosis; and in the latter, the epiphysis is often cast off as a foreign body, and recovery can only take place on its exfoliation or removal.

In both classes of cases, however, the treatment is in a measure the same; that is, all interarticular pressure is to be avoided, no standing on any account is to be allowed, and, when synovial disease exists, the application of a long splint is probably the best practice, for movement of the joint unquestionably tends to interfere with reparative processes, and retards recovery. At times, particularly in articular ostitis, simple extension by means of the weight and pulley answers every purpose. Dr. Sayre's splint is also valuable. In the early stage of synovial disease, as well as of articular ostitis of the hip, recovery with a sound joint may be secured by early appropriate treatment; but in a large number of cases, where time has been allowed to pass, and disease has gone on to produce degenerative changes in the articular cartilages, recovery, with ankylosis, is to be looked for; ankylosis without suppuration being more common after articular ostitis than after synovial disease (*vide* paper, by author, in "Med. Times," July and August, 1869).

When suppuration has appeared in the joint, recovery with ankylosis can alone be looked for; and in many cases this result cannot be expected, unless the diseased bone is cast off, or the diseased tissue removed. In this class of cases the most severe examples of hip disease are to be found; for it is certain, when suppuration of a joint has taken place, that the more or

less complete disorganization of that joint has likewise ensued. It is true that when an abscess has been the result of chronic changes in a pulpy synovial membrane, the complete disorganization of the joint need not, as a necessary consequence, be looked for, although where it has followed upon disease in the articular extremities of the bones—articular osteitis—it is more than probable that the articular cartilages will have been completely destroyed with the ligaments and synovial capsule. There is, however, this difference between the two classes of cases: when the suppuration has taken place as a consequence of synovial disease, recovery may take place with soft or fibrous ankylosis, or even with some degree of movement; but when recovery follows upon disorganization, the result of articular osteitis, although fibrous ankylosis may take place, osseous ankylosis can only occur when the cartilages, with the articular lamellæ of bone, have entirely gone, and there is no necrosed bone left to keep up the disease; for when this complication exists, a natural recovery cannot take place till the source of irritation has been discharged by natural processes or removed by art.

When suppuration, therefore, takes place in a hip-joint, although recovery with partial movement may follow, there is but one result that a surgeon can reasonably look for and strive to secure, and this is ankylosis. Should he be able, by the clinical history of the case and the existing symptoms, to make out that the disease began in the synovial membrane, and that the suppuration was the result of pathological changes following upon such an affection, the hope of securing a good result is very great; for the disease in the joint, however complete it may be, is probably only superficial, and does not involve the bones to any extent, and consequently a good recovery with a stiff joint may fairly be anticipated. Should, however, the clinical history of the case and existing symptoms indicate disease of the bones, the probabilities of the same result taking place will rest entirely upon the amount of disease in the bone, and not upon the extent of disease in the joint. If the disease in the bone be superficial, a natural cure by ankylosis may be looked for; for even dead bone, if not too large, even the epiphysis, may be discharged externally, and a good recovery follow. Should, however, the disease in the bone be extensive (Fig. 363), or a sequestrum be so placed in the centre of the bone as to keep up irritation, and interfere with repair, as shown in Fig. 354, page 756, the surgeon's active interference will be imperatively demanded, and it may be added that under no circumstances is it practiced with better results.

In disorganization of the joint, the result of synovial disease, recovery may take place with a movable joint with fibrous ankylosis. In disorganization of the joint, the result of osteitis, recovery can only take place by ankylosis; in some cases bone having failed to exfoliate, has to be removed; ankylosis is only to be looked for without surgical interference, when no dead bone can be made out to exist, and the natural powers of the patient appear good enough to make progress against the disease. To secure this end the complete immobility of the limb is to be insured by splints, and at times by extension by means of weights. In some cases a long outside splint is enough, in other cases the weight is sufficient. In very chronic cases some immovable casing of leather, gutta

FIG. 363.

Prep. 1318⁹⁹. Head of femur altered by disease—removed by excision.

percha, felt, wire, or perforated zinc, or other appliance, such as the fancy or ingenuity of the surgeon suggests, is the best; absolute immobility of the joint, prevention of interarticular pressure, tonic treatment, liberal regimen, good air, and time, being essential elements for a successful issue. Fig. 364 represents the apparatus I commonly use, with extra cross foot-piece to insure immobility when the patient is in bed.

FIG. 364.

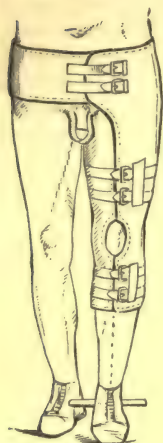
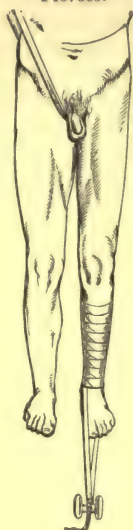


FIG. 365.



When some malposition of the thigh exists, such as flexion or adduction, when the limb has assumed a position which would be detrimental to the patient's welfare, it is essential that such a fault should be remedied before the plan of treatment already laid down is carried out, and as long as no ankylosis has taken place, or the union is soft, there is a good prospect of the treatment being successful. Chloroform should be given, and the thigh slowly but surely brought down to a straight line with the body, and there fixed by means of a long splint and foot-weight. At times the splint may be applied to the sound side and the weight to the affected one. It is to be remembered,

however, that the prudent surgeon's aim is to prevent the limb assuming a wrong position. After the forcible extension any overaction may be checked by the local application of ice or hot fomentations, according to the comfort they give the patient. At times, however, active disorganizing changes and bad results follow. When displacement or dislocation of the joint exists it is often in the surgeon's power to reduce the dislocation, and then to treat the case as one of the ordinary kind. I have seen and treated some such, and with good results. In the one from which Fig. 365 was taken the disease had been acute. The boy was eleven years of age; the dislocation was on to the ilium; its reduction under chloroform was readily effected and the result was good. A weight of six or seven pounds was enough to keep the limb in position, and the counter-extension was well applied on the opposite side of the pelvis.

When the displacement is of long standing, and the natural cure of the disease has gone on to its end, it is not wise to interfere, to run the risk of undoing what nature has well done; for many of these cases of supposed dislocations are nothing of the kind, they are simply a shortening of the neck of the bone, from the absorption or destruction of the head of the bone or epiphysis, or, at times, of the acetabulum. In exceptional instances the displacement of the limb is due to a separation of the neck of the bone from the epiphysis, which is left fixed in the acetabulum, or is cast off. Drs. March and Sayre, of New York, deny the existence of a dislocation, but in this they are wrong; it does occur, although but rarely. In the case from which Fig. 365 was taken it was very clear.

When ankylosis has taken place at a bad angle—at such an angle as seen in Fig. 366—any attempt at forcible flexion must be looked upon as unjustifiable, although it may be right to consider the propriety of making a false joint by the subcutaneous division of the neck of the bone by means of a fine saw, as is ably done in recent times by Mr. W. Adams ("Brit.

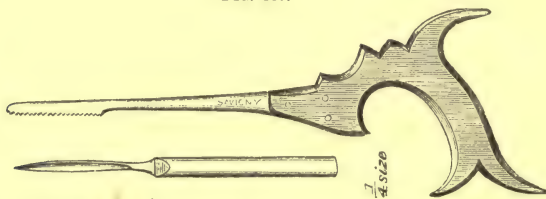
Med. Journ.," 1870). This operation seems preferable to Dr. Barton's, who divided the femur between the trochanters, or that of Sayre, who excised a wedge of bone from between the trochanters. It has been successfully repeated by Messrs. Jessop, Jowers, and Jordan.

The instruments required are such as those figured below (Fig. 367). The operation itself I give in Mr. Adams's words. "I entered the tenotomy knife a little above the top of the great trochanter, and carrying it straight down to the neck of the thigh bone, divided the muscles and opened the capsular ligament freely. Withdrawing the knife, I carried the small saw along the track made—pursuing this by pressure of the fingers—straight down to the bone, and sawed through it from before backwards, in the direction represented in Fig. 368, which shows the saw applied to the anterior surface of the neck of the bone. The section of the bone was accomplished in four minutes. No hemorrhage followed, and a good recovery took place with a stiff limb."

FIG. 366.



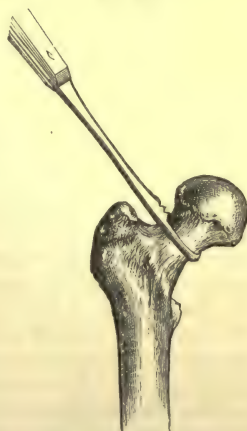
FIG. 367.



I had the opportunity of seeing Mr. Adams perform this operation a second time, and can bear witness to the facility with which it can be executed.

In a pathological point of view there seems to be little doubt that, in a large number of cases of suppurating hip-joints, natural processes are amply competent to produce a natural cure by ankylosis or otherwise, the exceptions to this general rule including the cases of necrosis of some part of the bones entering into the formation of the joint, and those of extreme feebleness on the part of the patient who may be the subject of the disease. Under the former circumstances natural processes are prevented from pursuing their welcome offices by the constant presence of a foreign body, for such dead bone must be regarded; and under the latter, the powers of the patient are incompetent to supply the demand made upon them for the repair of such an affection as a suppurating joint. In every case, therefore, of suppurating joint the surgeon has to make out whether locally there are any conditions present that may prevent a natural recovery from taking place, and if so, he has to decide upon the plan of treatment by which these conditions may be altered or removed. If locally he can find no such pathological cause to interfere

FIG. 368.



From Adams.

with a natural cure, he has to determine whether the patient's powers are competent to meet the demand that must necessarily be made upon them to secure such a result.

Such points are always difficult to decide, but when necrosed bone can be made out to exist its removal is always called for, whether by a partial operation, simply for its removal, or by resection of the head of the femur. The subject of excision of the hip-joint will, however, claim our attention in another chapter. Dr. Fitzpatrick has suggested and adopted the practice of treating acute and articular osteitis, in the stage of inflammatory congestions of the hip and other joints, by means of caustics, making a caustic tunnel into the trochanter or inflamed bone. He advises it before the joint has disorganized in the early stage of the disease, and when the joint is converted into a foul suppurating cavity. In the intermediate periods his experience does not warrant him in advising the practice. He was led to adopt the practice in joint cases from witnessing its benefit in an inflammatory affection of superficial bone. The practice consists in piercing the bone with a strong knife or trephine, and cauterizing the cavity with a stick of the potassa cum calce. ("Bien. Retrospect," 1867-8.)

The treatment of diseases of the knee-joint may be taken as a type of the treatment of all joint diseases.

Acute synovitis is usually the result of some wound, and is to be treated according to the principles laid down in Chapter LXVIII, by rest and ice locally and opium internally; when not subdued rapidly, disorganization of the joint ensues, and few cases are more serious in their local as well as their general effects, the joint usually completely disorganizing, and, under these circumstances, it is exceptional for life to be spared. When disease is the result of septicæmia, or the rupture of an abscess into the joint, the success is no better.

In subacute and chronic forms of synovitis a good result may, as a rule, be promised, and the treatment must be directed by the cause of the disease. In traumatic cases the local application of cold or warmth, according to the amount of comfort they afford, and the immobility of the limb, aided by splints, is often enough; gentle support, by means of well-applied strapping, being a valuable adjuvant when only a relaxed condition of joint remains.

At other times the application of a blister to either side of the joint and the internal administration of the iodide of potassium, with or without bark or quinine, according to the necessities of the patient, are of great use. When gout appears to be an element in the affection, colchicum is of value; when rheumatism, alkalies; when syphilis, iodine or even mercury.

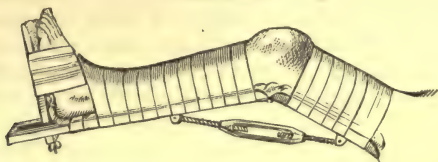
Paracentesis of the joint is an operation that has been performed, and, in the hands of some surgeons, with marvellous success. Dr. Fayrer, of Calcutta, is one of its strongest advocates, having shown ("Indian Med. Gaz.," 1869) that in the chronic and subacute forms much good is often obtained by the operation if care be taken to exclude the air by carefully closing the puncture and fixing the joint on a splint, the drawing off of the fluid affording instantaneous relief. I have performed this operation once with a good result in a case in which the tension of the joint was extreme, and in another case, operated on by Mr. Cock, a similar result was obtained; it is a practice, however, that ought to be followed with extreme caution.

The *pulpy disease* of the synovial membrane is a very obstinate affection, and although fairly curable in its early stage, and occasionally later on, with a movable joint, is always tedious and unsatisfactory.

The absolute immobility of the joint is the most essential element in its treatment, and this is only to be guaranteed by the application of a well-adapted splint (Fig. 369). As long as any inflammatory action remains

the posterior splint, reaching from the heel and foot two-thirds up the thigh, is as good as any, although after this stage of the disease has passed away some good leather, gutta percha, or felt casing may be employed. As long as any heat or periodic flushing of the joint exists, the limb must be kept

FIG. 369.



raised, and warm moist applications applied by strips of lint surrounding the joint; after these symptoms have subsided and the products of inflammation alone remain, well-applied pressure, by means of strapping, is of great value. Mr. Marshall ("Lancet," May 25, 1872) speaks highly of the five per cent. solution of the oleate of mercury in oleic acid. Blistering and firing in this affection seem to be of little use.

The constitutional treatment is essentially a tonic one in all its stages, for the subjects of this affection are always feeble, and probably strumous; iron, quinine, bark, cod-liver oil, good food, and fresh or sea air are essential elements for success; the practice I have long employed with advantage in hospital work has been to order some solid iodine to be put into a perforated box, and the box placed on a shelf, the iodine then steadily evaporates, iodizing as it purifies the air.

By these means, as long as suppuration has not set in, a cure may be effected, although many months may be absorbed in its attainment.

When suppuration appears the same principles of practice are applicable; when small deposits of pus form from the breaking down of some portion of the pulpy tissues, and make their way through the skin, and not through the joint, they may be opened, and still a good result ensues. But when the joint disorganizes from the same cause, other questions arise as to the expediency or possibility of saving the joint or life of the patient, which will claim attention in the chapter on suppurating joints.

In **articular osteitis**, a disease readily made out in the knee, when simple expansion of the bones (Fig. 360), with an aching pain and heat, are the local symptoms, all walking or standing is positively to be interdicted, everything like pressure between or upon the affected bones is to be forbidden, fomentations with warm water are to be applied two or three times a day, and strips of wet bandage kept applied round the joint, and surrounded by a handkerchief of elastic tissue or oil silk. Blisters, moxas, and counter-irritants I rarely employ, having long found the above practice preferable. Some surgeons, however, speak highly of their value.

When heat has left the joint and the aching growing pains have disappeared, when the clinical evidence tends to show that all inflammatory action has subsided, and the results or products of inflammation alone remain, pressure on the part, as applied by strapping, is of great use; it not only gives comfort to the patient, but appears to help the absorption of the inflammatory products and the subsequent cure of the disease.

Constitutional treatment during this time is not to be forgotten. Tonic treatment is, as a rule, needed, and for children the cod-liver oil combined with the syrup of the phosphate or iodide of iron is a favorable recipe. When the appetite is bad quinine may be given; at other times iron, or other tonic. Good food and good air are as necessary in this as in all other

joint cases, the use of the iodine evaporating box not being forgotten; mercury is never needed.

It may be noticed that splints are not recommended; they are not required, for in the early stage of articular osteitis, the joint as a joint is not diseased, and no movement of the articulation will do harm. Extension by means of weights, to take away interarticular pressure, is, however, at times very valuable. In a more advanced stage, however, when the disease has so progressed in the bones as to have set up some degenerative process in the cartilages, when the synovial membrane has become involved, as indicated by synovitis or the pulpy thickening, the use of the splint is most essential.

In neglected knee cases, when the joint has been allowed to assume an abnormal position, the most common being that of flexion with some amount of rotation inwards or outwards, and in still worse cases of dislocation backwards, the deformity must be remedied by gradual extension employed through a posterior screw splint, or by manual extension exerted under chloroform. When the first method suffices it is probably the better, although manual extension employed with care rarely does much harm; forcible and sudden extension, although necessary in exceptional cases, is not to be recommended in a general way; it is at times followed by severe local action and suppuration.

When the deformity has been of long standing, the application of a constant gentle force, as exerted through one of the many instruments that have been made for the purpose, is to be recommended, the femur being gradually pressed backward, the head of the tibia forwards, and the foot being left free to move.

Anchylosis.—A knee-joint had better not be fixed quite straight; the best position is one of slight flexion, or that which a man naturally assumes when he stands at ease. But it is to be remembered that in the knee, anchylosis is more difficult to secure than it is in any other joint, on account of the presence of the interarticular fibro-cartilages that prevent the two bony surfaces from coming in contact. Moreover, when these cartilages are diseased they are most difficult of repair, no tissue undergoing a reparative process more slowly or imperfectly than fibro-cartilages. It is, doubtless, from the knowledge of these clinical truths that some surgeons despair of securing anchylosis in the knee, or even doubt its occurrence, and are led to interfere by operation oftener than others. Anchylosis of the knee—good solid ossific union of the bones, as well as fibrous anchylosis—does, however, occur, and when secured, is of great value. It gives a limb which is far superior to any other that follows excision, and is, as a rule, obtained without the dangers of an operation, although possibly with the expenditure of more time. I have the notes of many such cases, and in the "*Med. Times*," 1870, I published a series in which this result took place with and without suppuration.

Diseases of the *ankle-joint* are to be treated upon precisely the same principles as those laid down for the knee, the best position of the foot being an angle slightly exceeding that of a right angle.

Diseases of the *shoulder-joint*, in their progress and treatment, are very similar to those of other joints. When the shoulder has to be fixed, a good leather casing, including the scapula and humerus, is the best apparatus, the elbow being at the same time supported. The arm should be allowed to hang parallel to the trunk, with the elbow slightly away from the chest.

Disease of the *elbow-joint* can be usually managed with greater ease than any other, a splint applied in the flexure of the joint, passing well down to the hand to keep the radius in a position intermediate between pronation

and supination, being the best. If the hand be left unsupported it is sure to assume the prone position, which is, as a rule, undesirable. Dislocation of this joint rarely takes place as a result of disease, except at the head of the radius, which is often displaced backwards and somewhat outwards.

Before fixing the joint at an angle it is well, in most cases, to consult with the patient, for, in some cases, the straight position is the more desirable. In the case of a painter I had under care, a flexed elbow would have lost him his occupation. In another, that of a bargeman, the joint was fixed at a right angle, with the hand pronated, to hold the oar. A carpenter asked me to fix his left elbow at an obtuse angle. A haycutter had his right arm fixed nearly straight. In all these instances any other position would have been most detrimental.

In disease of the *wrist* and *carpus* the same position of the hand is to be maintained as in disease about the elbow.

In disease of the phalangeal joints, when ankylosis is to be obtained, I have often felt that the straight position of the finger is very inconvenient, and of late years have always fixed the diseased extremity at such an angle as will allow its point to come in contact with the top of the thumb. In this position the fingers are more useful; they are less in the way, and the deformity is less observed.

A piece of zinc or tin is the best material to use as a splint; it is thin and takes up little space; it is likewise firm.

CHAPTER LXXV.

ON OPERATIVE INTERFERENCE—EXCISION AND AMPUTATION IN JOINT DISEASE.

IN the treatment of joint disease, next to the preservation of life, the aim of the surgeon is to preserve the natural movements of a diseased articulation; and when that hope has gone, his object is to save the limb. When this end can be obtained with a stiff joint the result may usually be regarded as a satisfactory one, particularly in disease of the lower extremity, and even in the upper a stiff shoulder or elbow-joint, at a good angle, is not so bad a result as some surgeons would lead us to believe.

When neither of these ends appear probable, possible, or expedient from the extent of the local disease, the general want of power of the patient, or the necessities of the individual case, the question of operation comes before the surgeon, and he has to decide whether an incision into the joint, the removal of dead bone, the excision of the joint, or amputation, is to be performed. To work out the many points involved in the solution of these questions is a task of difficulty, for a form of practice which is applicable to one joint may be inexpedient in its application to another. This difficulty is doubtless due to the different value which surgeons place on different forms of practice, and the estimation with which they regard natural processes. A surgeon who has intense faith in natural processes in the cure of disease, and particularly of joint disease, will attempt to save a limb that another will condemn, regarding any practice as wrong that interferes with a natural recovery, as long as any reasonable hope exists of securing such a result; he believes that a cure by ankylosis, however acquired, and however long a time may be passed in securing it, is worth the attempt.

A second surgeon, having stronger faith in surgical treatment, will excise a joint, believing it to be inexpedient to waste time for a natural cure, even when it may be gained, when by excision he believes an equally good, if not a better result can be secured in a shorter period. Whilst a third surgeon, looking upon both forms of practice as too protracted and uncertain, will remove the diseased parts by amputation, under the conviction that a more certain result and a more rapid recovery would be secured by such a process.

To lay down any definite rules upon these points is an impossibility, for what is good or justifiable in the treatment of one joint may be bad or unjustifiable practice in another. Of the various joints each has, therefore, its own surgery, which I propose now briefly to consider.

As a starting-point, however, it may be stated that no surgical operative interference is ever justifiable, unless a joint has suppurated or become disorganized; and that amputation is only to be thought of when all minor measures are inapplicable, and when it is a necessity to remove the disease to save life.

The larger the joint the greater the evils of operative interference.

On the Treatment of Suppuration of the Hip-joint.—In the treatment of a suppurating hip-joint, as of any other articulation, it is a most important point of practice to insure a free vent for all discharge; pent-up matter is always injurious in any articulation, whether connected or not with diseased bone, and it is a point of practice of considerable importance for the surgeon to look to. A free incision into an abscess connected with the hip, or the free opening of a sinus through which pus slowly flows, rarely if ever does any harm, and, as a rule, does much good; it should always be adopted when pus exists, and its free discharge is not allowed. In the residual abscesses of repairing joint disease it is, however, well not to open them too early, or, indeed, at all, unless they show a tendency to increase, when they should be opened by a small incision, or by means of a trocar and canula, or pneumatic aspirator; after this many of them dry up.

On Excision of the Hip-joint.—When dead bone can be made out to exist in a suppurating hip-joint, there can be no question about the propriety—nay, necessity—of its removal, and as it is generally in or about the head or neck of the femur, it seems tolerably certain that the best practice lies in excision of that head. When the pelvic bones entering into the formation of the hip-joint are also involved, there seems to be no strong reason against the removal of any part that may be necrotic; for it is certain as long as such remains to keep up irritation a cure by natural processes is impossible. An operation undertaken upon the hip-joint, under these circumstances, is scarcely more than any severe operation for necrosed bone, and, in all probability, is not more dangerous. The joint as a joint has to a certainty disappeared altogether, and a free incision into it will hardly add to the dangers of the case. An operation undertaken under these conditions should be classed with those for dead bone. When the acetabulum is only superficially affected or stripped of its cartilage, there is no reason why the diseased head of the bone should not be removed; for the disease in the pelvic portion of the joint is probably secondary to that in the femur, and will undergo a natural repair as soon as the source of its disease has been removed.

When the disease in the pelvis is extensive, the operation of excision may certainly be an open question—that is, of excision of the head of the femur alone; for if the pelvic bones are necrotic or irreparably diseased, it is quite certain such an operation will be of little use. If the necrosed pelvic bones can, however, be removed (and there is no limit to the capa-

bilities of surgery in this respect), there is no reason why the operation should not be followed by a good result; for operations for necrosis, however extensive, are, as a rule, successful, and when performed on the disorganized hip-joint, there is no reason why they should not be attended with a like success. Extensive gouging of inflamed or so-called carious bone, whether about joints or otherwise, I always look upon with disfavor. The gouging, I am disposed to think, does as much harm as good when applied to any other than dead bone. The removal of dead bone is always a good practice, but the gouging of inflamed bone I hold to be unnecessary, if not injurious.

When the presence of dead bone cannot be made out, or evidence exists that no such complication seems to interfere with a natural recovery, it is still a disputed point amongst surgeons whether excision of the head and neck of the femur be a necessary or even justifiable operation; for those who argue against its adoption assert, and with some truth, that all these cases of hip disease are capable of a natural repair in patients who have good or even tolerable reparative powers; and that in those that have not, the operation of excision would naturally fail, for as much power is probably needed to effect a cure after excision as is demanded for the natural cure of an uncomplicated suppurating or disorganized joint.

To these latter remarks, however, I am disposed to demur. I am ready to admit—indeed, I sincerely believe—that, in all cases of disorganized hip-joint in which disease of the bone does not exist to interfere with recovery, a natural cure may fairly be looked for at no distant date, as long as the powers of the patient keep up their strength, and no signs of failure make their appearance. But when these signs show themselves in a decided way—when evidence exists that in the battle of disease the reparative processes yield to the morbid, and that treatment fails to turn the scale in their favor—it becomes an open question, which we will appeal to facts to decide, as to the expediency of performing excision; although I may at once admit that I believe the operation, under such circumstances, to be not only justifiable, but highly advisable. The removal of the source of irritation decidedly acts beneficially upon the patient, and many a case has gone on to recovery after the operation of excision that would, I believe, if unoperated upon, have eventually succumbed to the disease, worn out by suppuration and exhaustive efforts of repair.

For facts in reference to excision of the hip-joint I have gone to Hodge's work, and to a recent paper by Dr. R. R. Good, of Paris, the former author giving us a statistical table of cases up to 1861, and the latter from 1861 to 1868. Hodge gives us 111 cases, 56 of which recovered, and 53 died. Good quotes 112 cases, 52 of which recovered, and 60 died; a little more than half of the whole number of cases have thus proved fatal.

Mr. Holmes also, in his excellent work on children's diseases, gives us 19 cases, of which, in a general way, one-third died from the operation, another third recovered with useful limbs, and the remaining third, although not recovering, derived great benefit from the operation.

On analyzing these cases a little closer, and more particularly inquiring into the influence of age upon the operation, some valuable facts came out; for in 100 cases as given in Hodge's work, in which the age of the patient was reported, and in which amputation was not subsequently performed, I found the following results: Out of 46 cases operated upon under ten years of age, 15 died, or 33 per cent.; out of 37 cases operated upon between eleven and twenty years of age, 21 died, or 57 per cent.; out of 12 cases operated upon between twenty-one and thirty years of age, 7 died, or 60 per cent.; out of 6 cases operated upon over thirty years of age, 5 died, or 83

per cent. The analyses of Good's cases indicate the same truths, for of the cases operated upon under twelve years of age, 40.6 per cent. died; between twelve and twenty years of age, 60 per cent. died; between twenty and fifty-eight years of age, 76 per cent. died.

In young life, therefore, when hip disease is usually met with, excision of the head of the femur is by no means a fatal operation, as two out of three get well; from ten years to thirty years of age, something less than half recover, and after that period it is full of danger. Excision of the hip-joint is clearly more dangerous as age increases, and in this it is like amputation, lithotomy, or any other great operation. Children beyond infancy bear these severe measures well, and it is important that this fact should ever be before us. It is, however, of equal importance to remember that it is in young life we meet with the best success in the treatment of disease—in hip-joint as well as in other joint affections.

Recognizing the fact, therefore, that excision of the head of the femur is not only a justifiable, but a good operation in selected cases, let us briefly consider under what circumstances it should be performed. From the general facts as learnt from statistics two great results clearly come out,—that in childhood this operation is attended with success, two patients out of three recovering, and that in adult life it is attended with great danger, at least two out of three patients dying. In the former case, consequently, the operation may be entertained under circumstances which in the latter would render it clearly unjustifiable. With these two broad truths before us, let us enter a little into particulars in our endeavor to determine the question. When should excision of the hip be performed? And, first of all, when should it not be performed? It should certainly never be performed in cases in which suppuration or disorganization of the joint has not taken place; for as long as this condition is kept off, by surgical as well as medical skill, a sound hope exists that a cure of the disease, although by ankylosis, may be secured. The cases I have already quoted on previous occasions illustrate this fact. It should not be performed when all evidence tends to show that the bones entering into the formation of the joint are not extensively involved, or necrotic wholly or in part, and when the general condition of the patient under proper treatment is fairly maintained. It should not be entertained for disorganization of the hip-joint as the result of synovial disease, unless it is clear that the general health of the patient is gradually yielding to the disease. It should never be performed for acute suppurative disease.

On the other hand, it should always be entertained when it is clear that extensive bone mischief exists, or partial necrosis; for it is tolerably certain that, under such circumstances, a cure by natural processes is highly improbable. It should always be entertained when the general health of the patient is clearly giving way under the influence of the local disease, whether that disease be in the bones or synovial membranes, or both.

I believe these general conclusions respecting excision to be based on a fair interpretation of the clinical and pathological facts which have been published; they can only be given as general guides to practice. I have practiced the operation on six occasions, in five with success.

The operation of excision is best performed by a slightly curved incision extending from two inches above the trochanter along its posterior border to two inches below, more room being given at the upper angle of the wound by a cross incision when required. This incision gives abundance of room, and allows of the rapid exposure and enucleation of the head and neck of the bone; a good assistant is of great value in the operation. There seems also an equal unanimity amongst those who practice excision

that the head, neck, and trochanter (major) of the bone should be removed, the latter when left acting as a constant irritant against the soft parts and pelvic portions of the acetabulum, and retarding recovery. In this step the chain saw is often of great use. The surgeon should preserve all the soft parts around the bone as much as possible, and when the periosteum can be saved so much the better. Dr. Sayre, of New York, who has paid special attention to these cases, describes his operation as follows ("Brit. Med. Journ.," July, 1871): "When the disease has gone on to another stage, where sinuses have occurred and discharge pus, when a probe leads down to dead bone, there is nothing to be done but to exsect it by making a small incision above the trochanter major, midway between it and the crest of the ilium, over the top of the acetabulum, a semilunar incision, the belly of the curve covering the posterior part of the trochanter major going straight down to the bone *through* the periosteum; you then pull the soft tissues on one side, and, taking a small but strong curved bistoury, go as far round the bone on each side as you can reach, at right angles to your first incision, *so as to divide the periosteum completely*. You then take a strong firm periosteal elevator, with a large handle, and the end slightly curved, and go into this little triangle; you peel off the periosteum, and, as a matter of course, all the muscles with it; by opening the joint thoroughly, and turning the head of the bone out, the periosteum is peeled off from the inner portion; you then saw off the bone above the trochanter minor, taking away the head and neck of the bone with the trochanter major. After the operation, if you keep the leg pulled out to its proper length, by putting on a pair of wire breeches, you can send the patient out into the air the next day." I have given this operation in Dr. Sayre's own words, and am disposed to think as well of it as of his general treatment of hip disease. His wire breeches I have never used.

When the acetabulum is diseased—that is, when necrosed bone is present—it may be removed. In one of my own cases I removed a large portion of the bone; but Mr. Hancock has removed the whole floor with a good result; indeed, there is reason to believe that when the bone can be removed the case is not rendered more hopeless; for, as Holmes has well pointed out, there is always a strong fascia which separates the floor of the acetabulum from the pelvis, and prevents all contact with the viscera or their cellular connections.

After the operation the treatment is simple, the weight and pulley to keep up extension sufficient to prevent the end of the bone from rubbing against the pelvis is probably the best practice. Sometimes an interrupted splint answers every purpose, or Sayre's wire breeches may be used. As soon as the parts have fairly healed, passive movement may be allowed; and it is remarkable to what an extent useful movement is often secured, the patient being not only able to walk upon the limb, but to flex, abduct, and adduct it, nearly as well as he did before.

How far amputation at the hip-joint is an operation to be performed in cases of disease which have passed beyond all minor measures is an open question. I think I have seen cases where such a practice would have been justifiable. They must, however, be few and far between. The operation is one to be entertained in hip disease when all hope of a cure by natural processes, however ably assisted by art, has been abandoned, and the powers of the patient admit of a reasonable hope of recovery. The operation has been successfully performed by Mr. H. Lee and Mr. Holmes.

Excision of the hip-joint for gunshot or other traumatic injuries to the joint cannot be recommended. The report of Dr. Otis, in the admirably got-up circulars of the War Department of Washington (No. 2), proves

this to demonstration, for out of eighty-five cases only eight recovered; ninety per cent. having proved fatal. At the same time he shows that, by the expectant treatment, or amputation, no better results ensue. He concludes that excision of the hip may be performed in uncomplicated cases of gunshot fracture of the joint; that if unsuccessful, it relieves pain, and is attended with less risk than amputation, although life is probably prolonged for a longer period by the expectant treatment.

On the Treatment of Suppuration of the Knee-joint.—In a general way it may safely be asserted that in no case of inflammatory disease of the knee-joint in which disorganization has not taken place does the surgeon entertain the idea of operative interference; for, as long as this change is warded off, so long a reasonable hope exists of a cure, either with a movable or a stiff joint, and a useful limb consequently obtained. With our present knowledge this rule is probably a sound one, and it is generally followed. Exceptional cases may be seen in which it is inapplicable, but these are comparatively rare.

When suppuration has taken place in a knee-joint, the question of operation naturally suggests itself to the surgeon; for he asks himself whether natural processes are competent to conduct the case to a successful issue; whether the local disease is of such a nature as to be incurable, unassisted by art; whether the general powers of the patient are sufficiently good to bear up against the demands that will necessarily be made upon them in the progress of a natural cure; and last, but not least, whether it is expedient to make the attempt.

All these questions require for their solution much thought and judgment, and a careful weighing of probabilities. The cause of the disease and of the disorganizing process is also a point of primary importance. As a broad rule, when the disease is in the synovial tissue alone, and suppuration has taken place, a cure by natural processes, assisted by art, is generally to be secured, should the power of the patient be good. Pathologically there is no reason why recovery should not take place. On the other hand, as a broad rule, when the disease has originated in the bone and spread to the synovial membrane, and disorganization of the joint has taken place, a cure by natural processes is very improbable, and the removal of the diseased part by some operation is generally demanded. Pathologically, good reasons exist why recovery should not take place, and clinically this observation is borne out.

In suppuration of a joint from synovial disease, pulpy or otherwise, whether the result of a so-called rheumatism settling in the knee, of a puerperal synovitis, a traumatic synovitis, a gonorrhœal synovitis, or any other, a cure with ankylosis is by no means uncommon. It is true, in all these cases during their acute stage the danger to life is always great, and it may become a question whether an amputation is not needed to save it, or to give the patient a chance. Operations of amputation, however, undertaken for acute suppurative disease, are mostly fatal, and operations of excision are likewise equally unsuccessful. To my own mind I hardly think either of these operations is justifiable under such circumstances, and in this most men are now agreed. What I believe to be a better practice is the making a free incision into the joint—free enough to let out the pus that it contains, and to allow a free escape of all as it forms. The daily washing out of the joint with water is also a sound practice. No retention of pus should be allowed under any circumstances.

When suppuration has been set up in a joint from the degeneration of the pulpy synovial disease, the benefit of a free incision into the suppurating tissue is very great. It should always be practiced before any other

operative measure is undertaken, and a good hope of success attends the practice. When, however, suppuration has occurred in a joint from the extension of inflammatory mischief from the bones, the hope of securing a good result without some operative interference is very slender; for, as a rule, dead bone exists in the joint to keep up the irritation, and as long as it remains a recovery is highly improbable. In many cases, it is true, Nature does much towards this end, but she is rarely competent to perfect the cure without surgical aid.

In the following cases these points are well seen :

Case.—Disease of the Knee-joint—Suppuration—Removal of Necrosed Bone from the Joint—Recovery with Anchylosis.

James W—, æt. 17, came under my care in May, 1866, for disease in his right knee-joint. It had been of one year's duration, and had followed a fall upon the part. Swelling appeared directly after the accident, and was attended by severe constitutional disturbance and local pain. Suppuration also rapidly set in, several large openings making their appearance eight weeks after the accident. When I saw him, the joint was somewhat enlarged from inflammatory thickening of the soft parts, and was clearly undergoing ankylosis. The orifices were discharging. A probe passed into one of these readily detected dead bone in the joint. In September the man was admitted into Guy's under my care, and on October 13th, through a moderate incision made on the inner side of the patella, two flat pieces of bone, which were clearly the articular facets of the tibia, were removed. Rapid recovery and firm ankylosis of the joint followed.

Case.—Disease of the Knee-joint as a consequence of Articular Ostitis of Tibia—Removal of Sequestrum from Bone—Recovery with an Anchylosed Joint.

Henry R—, æt. 14, came under my care at Guy's Hospital on May 17th, 1867, for extensive disease of the shaft of the right humerus and head of the left tibia. It had existed for several years. For about one year the left knee had been enlarged from effusion, but no suppuration had ever taken place in it. When admitted there was necrosis of the shaft of the humerus, and likewise of the head of the tibia. Dead bone was readily felt in both parts with a probe. In the tibia the bone was clearly near the joint. The left knee was enlarged from expanded bone, and likewise from thickening of the soft parts around. There was no effusion. There was hardly any movement in the articulation. In November, 1867, I removed a mass of diseased bone from the tibia, and fixed the leg upon a splint. In six months he left the Hospital with a stiff knee and with a sound arm. In January, 1868, I removed a sequestrum from the arm, which included nearly the whole shaft of the humerus, and a good recovery ensued.

Case.—Disease of the Knee-joint as a Result of Articular Ostitis ending in Necrosis—Amputation—Recovery.

Edward L—, æt. 14, came under my care at Guy's Hospital on September 8th, 1868, for disease in the left knee-joint of seven years' standing. It had been discharging for many years. On admission the left knee-joint was completely disorganized and much enlarged; it was also partially ankylosed. Below the joint a sinus existed leading into the head of the tibia, and through which dead bone was felt. The boy's health was very bad, and it was clear nothing but amputation could be entertained. His urine was albuminous. The operation was performed on September 17th,

and a good recovery ensued. On examination of the joint the head of the tibia was perforated with a channel, which led from the joint to a mass of necrosed bone. The articular facet of the tibia was likewise necrosed. The whole joint was disorganized; the preparation is depicted in Fig. 370. It was clear that the disease in the joint had been secondary to the disease in the bone. The drawing shows well the condition of the tibia.

REMARKS.—These three cases show well the results of articular ostitis when passing on to necrosis in the knee-joint, and fairly indicate the kind of practice that should be applied. In the first case Nature had done her utmost towards obtaining a cure, the knee of the patient having been on admission partially ankylosed; and, had it not been for the presence of the necrosed articular facet of the tibia, a complete natural recovery would have taken place. The surgeon's duty in this case was clearly to remove from the joint what seemed to be the sole obstacle to a natural recovery—the necrosed bone—and the complete success of the treatment justified the step, for the boy ultimately had an admirable limb. In the second case the disease was precisely of the same nature, and natural processes had done their utmost likewise towards the establishment of a cure, but the presence of necrosed bone in this case, as in the last, interfered with the recovery, and prevented its realization. On the removal of the bone from outside the joint, natural processes went on without interruption towards the attainment of their end, and a complete recovery, with ankylosis, was obtained. In the last case the same cause, articular ostitis, and the same result, disorganization of the joint, were clearly present; but the local disease in the bone was too extensive to give rise to any

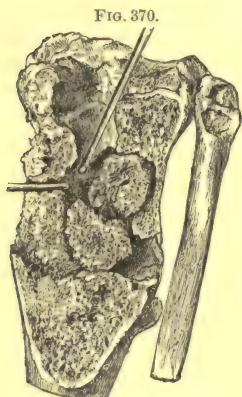


FIG. 370.
Abscess in bone burrowing into knee-joint, with necrosis.

hopes of good being derived from its removal, and the general condition of the patient too precarious to allow of the attempt. As a consequence, the only operative interference that seemed justifiable was carried out, and the issue of the case was all that could be desired. In disorganization of a knee-joint, therefore, the result of disease spreading from the bone—of articular ostitis—whether the consequence of an abscess in the epiphysial extremity bursting into the joint, of disease in the epiphysial cartilage between the shaft and epiphysis, or of a sequestrum in one or other of the bones entering into its formation, some operative measure is usually required; and, when the diagnosis of the case is tolerably clear, the practice ought to be decided, for delay cannot be of any use. The disease must be removed. What, then, ought that practice to be? Should it be excision or amputation? Let us refer to facts to help us towards a solution of these points. I have a table of 294 cases of amputation of the thigh for chronic disease of the knee-joint at various ages, and Dr. MacCormac tabulates 137, the total making 431 cases. Of these 96 died and 335 recovered, the mortality being 22 per cent., or 1 in 5. On referring to Dr. Hodge's work, I find 178 cases of excision of the knee undertaken solely for chronic disease of the knee; of these 70 died, and 108 recovered, the mortality of excision being 39 per cent., or 1 in $2\frac{1}{2}$ cases. In this comparison the circumstances are exactly similar. Both operations were undertaken for the same class of cases of chronic joint disease, and the mortality is exactly double. In my table of amputations, I have carefully guarded against any fallacy on the point, and have only gone to my own statistics, for the accu-

racy of which I can vouch,¹ and to Mr. Callender's,² that are equally indisputable with Dr. MacCormac's³ and Mr. Holmes's;⁴ and in the table of excisions I have gone to Dr. Hodge's work, who, to make this point certain, states that, with three exceptions performed for acute inflammation of the articulation, excision of the knee has probably never been undertaken for any other than chronic disease or white swelling. Mr. Swain, the author of the Jacksonian prize essay on "Excision," and a warm advocate of the operation, has given us likewise statistics on this subject, and from his book (pp. 62 and 64) I have extracted the following facts: Up to 1865 there had been 316 cases of excision of the knee. Of this number 85 died, or 26.8 per cent., nine of these having died after amputation, which had been deemed necessary in 39 cases of excision. Since 1865, 74 cases are given, 25 of which died from the operation, or 33.7 per cent.; 4 also died out of 11 that underwent subsequent amputation—in all, 29 cases out of the 74 died, or 39 per cent. Mr. Swain gives us also a select list of cases numbering 82, 15 of which died from the effects of the operation, and 4 others recovered after amputation. We thus have 472 cases of excision of the knee, and 129 deaths, or 27.3 per cent., 13 of these being after amputation; 41 other cases underwent amputation and recovered. Taking the whole number of 472 cases, 302, or 63.9 per cent., recovered after the excision; 41, or 8.7 per cent., recovered after secondary amputation; 129, or 27.3 per cent., died after excision; the mortality from excision was thus greater than from amputation in the same class of cases, the proportion being 27 per cent. to 22 per cent. It is also, adds Holmes, a somewhat suspicious feature in Mr. Swain's table that all the 302 recoveries are claimed as being with useful limbs. If the information had been at all adequately full, there would surely have been a category of recoveries with the limb more or less useless.

It is also a well-known fact that the utility of the limb in many cases in which it seemed perfect at first has been destroyed by subsequent changes. In childhood, suspension of growth is a not infrequent result, and when the whole epiphyses are removed it is to be looked for.

It is true that Mr. Swain gives somewhat different results from the same statistics, for he actually numbers amongst the recoveries after excision all cases that subsequently underwent amputation, whether living or dying, of course giving a far too favorable coloring to the operation he is advocating. If, however, we look to the *results of both operations as performed at different periods of life*, a point of comparison of immense importance, although entirely ignored by Mr. Swain and other advocates of excision, the following striking result comes out, and I would wish the advocates of excision to consider well these points and not to pass them by as of no importance. In my own table of amputations for chronic disease of the knee in patients under twenty years of age, out of 69 cases 3 only died or 4.3 per cent., or 1 in 23 cases. In excision for the same class of cases performed at the same period of life, out of 97 cases 27 died, or 27.8 per cent., or 1 in 3 $\frac{2}{3}$, the different degrees of mortality of the two operations under twenty years of age being as 4.3 per cent. to 27.8 per cent. *Excision being nearly seven times as fatal as amputation during young life*, it may thus fairly be asked whether the advantages of excision are so great as to justify its performance in the majority of cases of disease of the knee at that age. In amputations undertaken between twenty-one and forty years of age for chronic joint disease, out of 119 cases 38 died, or 32 per cent., or 1 in 3; in excision

¹ "Med.-Chir. Trans.," vol. xlii.

² *Ibid.*, vol. xlvii.

³ "Dub. Quart.," August, 1868.

⁴ "St. George's Hosp. Rep.," 1866.

undertaken under similar circumstances, out of 74 cases 39 died, or 52.7 per cent., or more than 1 in every 2 cases, the difference between the mortality of the two operations, 32 per cent. and 52.7 per cent. respectively, being 20 per cent. against excision. It would thus appear that it is in young adult life that excisions, although always more fatal than amputation, are the most justifiable, that in childhood they are far too dangerous; in patients past middle age all admit their inapplicability. And yet it must be admitted that excision of the knee-joint is a good operation; that when successful, a good useful limb is given, a far better limb than can be given after amputation. Nevertheless, the truth must be recognized that the operation is, as hitherto practiced, a far more fatal operation than amputation; and yet it may with confidence be asserted that the cases in which amputation has been performed are, as a rule, far more severe than those in which excision has been practiced. It seems true that the advocates of excision are disposed to operate at a somewhat earlier period of disease than the advocates of amputation, that is, the excisors often remove a disease they believe it is inexpedient to leave to natural processes to cure; whilst other surgeons only remove a limb when all hope of a natural cure has passed away, and it is a necessity to remove the limb to save life. Are the advantages of excision, therefore, so great as to justify a surgeon in submitting a patient to an extra risk in order to secure them? As hitherto practiced, and as a general rule in surgery, I have no doubt in answering in the negative. In exceptional cases, the risk may, it is true, be run to secure that end; but excision, as a rule of practice, does not appear to be a sound one. Whether better results would not be secured by an earlier operation is an open question; Prof. Humphrey's cases recently published rather tend to prove this to be the case; for, in excisions undertaken with a patient in good health, and not worn out by suppurative mischief, a good result may fairly be looked for. But is the risk of the operation, when performed under these favorable circumstances, so slight as to justify the surgeon in throwing aside the hope and perhaps fair expectations of securing a recovery with natural processes? Is excision of the knee to be an operation of expediency and not of necessity? We want facts to prove this fully; but, as far as present experience goes, it seems to show that, if the operation is to be as successful as well as a general one in surgery, it should be undertaken at a somewhat earlier period of disease than that at which the question of amputation has to be mooted; that it should be performed at a period of disease before surgical fever has reduced the powers of the patient; before complete disorganization of the joint has taken place. In fact, that it should not be practiced when an operation is demanded to save the life of a patient—for under such circumstances, a better chance is given by amputation—but that it should be practiced only when the local disease is found to be steadily progressing, in spite of treatment, and when disorganization is threatening. I would ask the advocates of excision to help us to a solution of these questions; to recognize the results of experience, so far as they can be obtained, and not to shut their eyes to them when they tell against the operation, or try to explain them away. Let their aim be, as is ours, to find out at what period of disease the operation of excision of the knee should be undertaken; for that is the one point we want now to have settled. As a substitute for amputation undertaken in extreme disease to save life, facts tell against the practice; as an operation of expediency to gain time, the few facts we possess tell in its favor. For my own part, I am disposed to think that, under these circumstances, there seems to be some hope that excision may not only be a successful, but may become a justifiable operation, and that it will not necessitate an increased

risk to the life of the patient. In doubtful cases amputation is the more desirable operation, for it is the safer; and, as the great object of our profession is to prolong and save life, other objects ought always to be subsidiary to this our great aim. In acute suppuration of the knee excision is never successful. Excision for gunshot wounds has been proved to be most unsatisfactory; indeed, as a practice in such cases it seems hardly justifiable. In compound dislocation it has been successful. Canton and M. Spillman have published such cases, but upon the whole the evidence we possess is not much in its favor in traumatic cases. Resection in cases of deformity is probably a better field for the operation; Drs. Barton and Buck, of New York, have demonstrated its value.

The Operation.—The best incision is that practiced by Fergusson, although suggested by Park; a straight one across the joint below the patella, from the *posterior* part of one condyle to the back of the other. When the tissues over the knee are bad, the incision may be a curved one, forming a flap. The old H-shaped incision is now rarely practiced. Humphry follows Mackenzie in making the semicircular incision with the convexity downwards, and Bickersteth, of Liverpool, makes a vertical one on the inner side of the patella. The joint is to be opened at once by dividing the ligamentum patellæ and the capsule of the joint, an assistant flexing the leg fully upon the thigh and thus facilitating this part of the operation. The soft parts are then to be turned back off the patella and that bone removed, there being no object in leaving it, but many reasons for its removal.

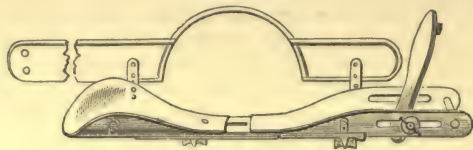
The joint having been freely exposed by the division of the lateral and other ligaments, and the forcible projection of the condyles, care being taken not to injure the popliteal vessels which lie in close contact behind, the end of the femur is to be excised, but not the whole of the epiphysis: the surgeon should take away the anterior two-thirds of the cartilaginous extremity of the bone; by taking away the whole, the epiphysis will be removed with some portion of the shaft.

This section is to be made completely at right angles to the shaft of the bone. The heads of the tibia and the fibula are then to be dealt with in the same way, no more of the bone being removed than is necessary. To do this, the bow-saw known as Butcher's is the best, the section being made from behind forwards. In both bones, when possible, it is well not to encroach upon the epiphysial line of the epiphysis. In dividing the bone care is required not to strip off the periosteum above the line of section. When the surfaces are not healthy or when they do not come together in a straight line, another section may be made, it being a point of primary importance that a perfect adjustment of the bones be secured. To aid this, the osseous suture as first employed by Gordon Buck, and practiced by Nélaton and some English surgeons, is to be recommended. All bleeding is to be arrested by torsion of the vessels and cold affusions, Humphry laying great stress upon this; and the parts are brought well together by sutures, some immovable apparatus being adjusted before the patient is removed from the operating-table. The Bavarian immovable splint, as described in the chapter on fractures, is probably the best. Price's modification of McIntyre's splint (Fig. 371) is a very favorite one. Dr. P. Heron Watson employs with the plaster of Paris an anterior iron suspension rod. Salter's swing is an invaluable adjunct.

Dr. Humphry first fixes the limb upon a posterior splint and foot piece, then unites the edges of the wound by sutures, and applies well-padded long splints to the sides of the limb, the wound being left exposed. "I am very particular," he writes ("Med.-Chir. Trans.," vol. lii), "to adjust things well and firmly in the first instance, and am very unwilling to disturb the

limb afterwards. Indeed, I frequently do not remove any of the bandages or splints for five, six, or more weeks, and by this care and perfect quiet I

FIG. 371.



From Holmes's book.

endeavor to promote immediate union. This perfect quiet and abstinence from removal of the bandages first applied is, I consider, a very important item in the treatment. It is equally important not to discontinue the splints till the bones are quite firmly united, till the patient can raise the limb from the bed by its own muscles, without any movement being perceptible between the tibia and femur. It is necessary to make quite sure of this."

Dr. Humphry adds "that excision of the knee is not an operation of much danger;" but it is to be remembered that he has little or no faith in the cure by natural processes. He believes such a cure in the bulk of cases to be hardly worth the attempt, and advises excision to be employed early in its place to bring about by operation that condition which we would gladly see attained without such interference.

On Suppuration of the Ankle-joint.—When the *ankle-joint* has undergone disorganization, and is suppurating, the benefit to be gained by a free incision is very great; it being by no means an uncommon result to obtain a cure with a movable joint. When this end is not secured a recovery with ankylosis may be looked for, it being exceptional for any more active interference to be called for, except when the bones are extensively involved.

When necrosis of one of the bones entering into the formation of the joint is present recovery may be looked for on the removal of the diseased bone. In the case illustrated in Fig. 372 I removed the necrosed upper half of the astragalus with an admirable result, a good foot with some amount of movement being secured.

Under these circumstances excision of the joint has been practiced, and with success. I have had no experience of this operation, having in the

FIG. 372.



Foot after removal of necrosed astragalus from child *set. 6.*

majority of cases of disorganized ankle-joints obtained good results by the expectant treatment, and by free incision; amputation in one of its forms being resorted to where the disease was too extensive to be successfully treated in these ways, and in such cases it is a question whether excision would be successful. Where excision may be expected to be successful is where the disease is limited to the articular surfaces of the bones, and it is in such that the treatment by incisions and the expectant principle is so successful. When the disease is very extensive amputation is probably a better practice. Stokes has collected 51 cases of excision, 38 of which were successful, and in the "Dublin Quart." for 1870 an excellent example by Dr. Murney may be referred to.

In cases of injury, of compound dislocation, and fracture into the joint,

excision is probably a sound operation. Langenbeck has practiced it freely with success, and Hancock ("Lancet," 1867) gives 19 successful examples—quoting Heyfelder and Jaeger's practice to support the operation; but even here it seems well to practice it as a secondary operation.

With respect to the operation itself, I may quote Hancock's operation as practiced in 1851, and given by Barwell with recent improvements.

The foot is first laid on its inside, and an incision is made over the lower three inches of the posterior edge of the fibula. When it has reached the lower end of the malleolus, it forms an angle and runs downwards and forwards to within about half an inch of the base of the outer metatarsal bone. The angular flap is reflected forwards, the fibula about two inches above the malleolus is sufficiently cleared of soft parts to allow cutting forceps to be placed over it, and the bone is then nipped in two and carefully dissected out, leaving the peroneus longus and brevis tendon uncut. The foot is now to be turned over. A similar incision is made on the inner side, the portion in the foot terminating over the projection of the inner cuneiform bone. The flap is to be turned back, and the sheaths of the flexor digitorum and posterior tibial tendons exposed, the knife being kept close to the bone, avoiding the artery and nerve. The internal lateral ligament is then to be severed carefully close to the bone; and now the foot is twisted outwards, and the astragalus and tibia will present at the inner wound. A narrow-bladed saw put in between the tendons into the inner wound projects through the outer. The lower end of the tibia, then the top of the astragalus may be sawn off in a proper direction. The only vessel that may require tying is one of the lower branches of the peroneal artery. The wound may be closed with sutures, except that part opposite the breach of osseous matter; the leg and foot placed in a splint with a foot board and cold water applied. Mr. Hancock points out the superiority of total over partial excision of the joint. Mr. Hey, of Leeds, in 1766, was the first surgeon who resected the lower ends of the tibia and fibula for compound dislocation, and Moreau, in 1792, for disease. Hancock was, however, the first to resect the joint as a whole. By way of summary Dr. Spillman's conclusion seems sound ("Archives Générales de Méd.," 1869). Partial or total resection of the tibio-tarsal joint on account of caries, necrosis or prolonged suppuration after a wound of a joint or compound dislocation is an excellent operation as a secondary one when the attempt to save the joint otherwise has failed. Resection in cases of disease is very hazardous except in partial resection of the fibula, which is generally successful.

Excision of the Shoulder-joint, or rather of the head of the humerus, is an excellent operation in gunshot wounds of the joint, in compound dislocation, or in cases of disease where a cure by natural processes has failed to follow judicious treatment, either from the extent of disease in the bone, or the general feebleness of the patient's powers. The ultimate results of excision of this joint, whether for injury or disease, are very satisfactory, says Hodges, but they are not more than the ultimate results of a cure by natural processes, even with ankylosis; for whatever may be the capabilities of an arm after excision they are equalled after a natural cure. Under both circumstances, in the majority of cases, almost every movement can be effected, except any overhand one. The arm cannot be raised above the shoulder. A man whose shoulder I excised fourteen years ago is now a coachman, and can drive a pair of horses with ease. A man upon whom Mr. Key operated was subsequently able to carry on his occupation as a hammerman at a large engineer's; and another case operated upon by the same surgeon 21 years before, could in June, 1869, "shoe horses with any man," and as a blacksmith felt no want in his arm.

In gunshot injuries to the shoulder excision is now a recognized operation, the experience acquired in the American war having decided the point. Dr. Hodges (Circular 6) has recorded that in 252 cases of primary excision, 23 per cent. died; and in 223 secondary, 38 per cent.; primary excisions being thus more successful than secondary.

In cases also of tumors involving the head of the bone, other than cancerous, excision is an operation of value.

The Operation.—The best incision is the vertical one, from the acromion process through the thickness of the deltoid down to its insertion. Some surgeons make an anterior one in front of the deltoid. Nélaton uses the transverse; Aston Key used to employ the deltoid flap. When the vertical incision is made down to the bone, its head should be successively rotated outwards, and then inwards, the surgeon making a transverse cut across the tuberosities to divide the insertions of the scapular muscles. The capsule may then be divided, and the head of the bone turned out of the wound, and resected through the tuberosities. The long tendon of the biceps needs no special attention; in cases of disease it has probably long gone or become fixed to the groove, and after resection of the joint it is of no value. When the glenoid cavity is diseased—that is, when dead bone is detected in it—it should be removed; but in a general way it requires no treatment. Whatever vessels are divided should be twisted; the posterior circumflex artery at times gives trouble. After the operation the arm should be abducted and placed on a pillow, the edges of the wound carefully brought together, and water-dressing or dry lint applied. As soon as repair has fairly taken place, the patient may get up, the arm being well supported in a sling. Three or four months are, however, usually required before a useful arm is secured.

In this operation M. Ollier makes much of preserving the periosteum, turning it back off the bone with all the soft parts, by means of raspatories. This is not so difficult in cases of disease as might be fancied, a cut with a strong knife down to the bone so dividing all the soft tissues over the bone as to give admission to the edge of a raspatory to turn them back. Ollier has done this on four occasions with success. In resecting the bone no more need be removed than is necessary beyond the head and half the tuberosities; but when the section is not healthy another may be made. Four or five inches of bone have been removed in some cases, a useful limb remaining.

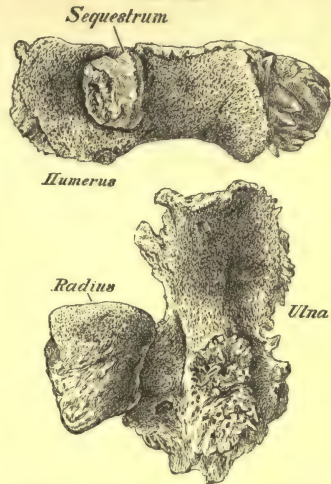
On Suppuration of the Elbow-joint.—There is a great difference amongst surgeons as to the treatment of a suppurating elbow-joint; in the Scotch school excision is employed very freely, under the belief that a better arm more generally follows such a practice than a cure by natural processes; that is, that a joint with better movement is secured in a shorter time. I cannot say that I agree in this opinion, for in elbow-joint disease, where pus is let out by free incisions, and good reparative power is present, recovery with a movable joint, and with one admitting of pronation and supination, is by no means uncommon. In other cases ankylosis of the humero-ulnar joint may take place at a good angle, pronation and supination of the hand being retained; whilst in another class ankylosis of both bones may take place, with a very useful arm; and this result is obtained by no greater expenditure of time than is required for the repair after excision, and it is secured without the risks of an operation. In synovial disease ending in disorganization this result is far from being uncommon; indeed, in such cases excision is rarely called for. In bone disease ending in necrosis, however, the same rule does not apply, for under such circumstances no operation is of greater value than excision. (Fig. 372a.)

In all cases of disease of the elbow-joint in which natural processes are incompetent to effect a cure, excision should be performed; amputation being had recourse to only when excision is inapplicable, or has failed. In cases of compound dislocation, or fracture into the joint, excision is an excellent operation, and in gunshot wounds the same observations apply. Amputation of the arm for injured elbow ought to be performed in quite exceptional cases.

Operation.—The best incision is the vertical over the olecranon process, extending from three inches above to two below the joint, the incision dividing all the tissues down to the bones; the soft parts should then be carefully separated from the bones and drawn aside, the ulnar nerve being raised from the inner condyle, with the inner half of the triceps tendon and fascia. *No transverse incision across the triceps tendon should be made*, it being a very important thing, as recommended by Dr. R. Hodges, of America ("Hammond's Essays," 1864), and recently well demonstrated by Maunder ("Brit. Med. Journal," 1871), to retain the triceps tendon and fascia, as it passes over the olecranon with the fascia of the forearm and anconeus muscle a thick body of muscle and fascia is in this way retained, extending from the arm above to the forearm below, which adds materially to the extending power and value of the arm (Fig. 373). The articular ends of the bones should then be turned out and removed. The surgeon need not be too sparing of his sections. In all cases the whole of the articular facets should be resected, and when the bone at the point of section is not quite healthy a second piece had better be taken away. "If only the extreme ends of the bones be sawn off, ankylosis will most likely take place; while if the amount above prescribed, viz., the whole condyloid extremity of the humerus and all the sigmoid cavity of the ulna with the head of the radius, or even a little more on both sides, be taken away, free motion may, under favorable circumstances, be expected. ("Holmes's System," vol. v.) When possible it is well to preserve the insertions of the biceps and brachialis anticus tendons by pressing them back off the bones. To preserve the periosteum in the operation, as advocated by Ollier and Langenbeck, does not appear from published facts or scientific reasonings to be a matter of importance.

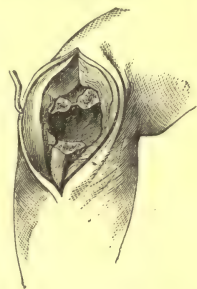
After the operation the edges of the wound should be brought together, and the arm fixed at an obtuse angle upon a screw splint, all hemorrhage having been arrested by torsion and cold affusion. Absolute rest should be maintained for some days till the wound has fairly healed and the powers of the patient have been restored, when passive movement should be commenced with pronation and supination of the hand, the object of this operation being not only to remove the disease, but to obtain a movable joint. When ankylosis follows, the operation, in a measure, is unsuccessful.

FIG. 372a.



Illustrates such a case in which the operation was successfully performed.

FIG. 373.



ful, for it has failed in one of its greatest advantages. In the most favorable cases the amount of movement that is obtained is all that could be wished, indeed, it is little less than that of the healthy joint; in some cases, however, the joint is too loose, even as a flail, in others it is stiff. In another class flexion and extension are good, but pronation and supination fail. In Mr. Syme's case of a man who had acted as a railway guard up to the time of his death, nine years after the operation, when the joint was dissected the ulna and humerus were united by ligamentous union, and the end of the radius was polished off and played on the humerus and ulna upon a material much resembling cartilage. Should the ulnar nerve be injured much wasting of the muscles must occur; if divided, union of the ends may, however, take place. Syme has recorded such a case. When disease returns, a second resection may be performed, and even a third. When dead bone follows it may be removed, indeed nothing should be left untried before amputation is practiced.

Partial resections of the elbow, as a rule, are to be condemned, experience having indicated that they almost always end in ankylosis of the joint. In 1864, however, my colleague, Mr. Birkett, excised the olecranon for local disease following an injury, the man recovering after many months' treatment with a slightly movable articulation.

On Suppuration of the Wrist-joint.—In this affection operative interference is rarely called for, beyond free incisions to let out all pent-up pus, and the removal of dead bone when its presence is made out; the absolute immobility of the hand and fingers, aided by such constitutional remedies as the wants of the individual case suggest, being, as a rule, enough to effect a cure. When, however, such means fail, or the local disease is too extensive or severe to allow of a natural recovery, Lister has proved that the excision of the joint is a practicable and useful operation. Hancock and others have likewise had successful examples. He has shown, writes Holmes, that the failures to which the old methods of performing this operation usually led were due to two chief causes, viz., (1) a portion of the diseased articular structures having been left behind; and (2) the tendons having been injured. In order to avoid the former it is necessary to remove all the bony and cartilaginous structures which enter into the formation of the wrist-joint itself, and of all the carpal joints, viz., the ends of the radius and ulna, all the carpal bones, and the articulating surfaces of the metacarpal bones. In order to avoid the second cause of failure the operation must be performed through two very free lateral incisions, the tendons being carefully separated from the bones and raised by gradual strokes of the knife with as little violence as possible. For this purpose an incision is made, commencing in front over the second metacarpal bone internal to the tendon of the extensor secundi internodii pollicis, and running along the back of the carpus, internal to the same tendon as high as to the base of the styloid process of the radius; the soft parts, including the extensor secundi internodii and the radial artery, being cautiously detached from the bone, external to this incision, and the tendons of the radial extensors of the wrist being also severed from their attachments, the external bones of the carpus will be exposed. When this has been done sufficiently, the next step is to sever the trapezium from the other bones with cutting pliers in order to facilitate the removal of the latter, which should be done as freely as is found convenient. The operator now turns to the ulnar side of the incision and cleans the carpal and metacarpal bones as much as can be done easily. The ulnar incision is now made; it should be very free, extending from about two inches above the styloid process down to the middle of the fifth metacarpal bone, and lying near the anterior edge of the

ulna. The dorsal line of this incision is then raised along with the tendon of the extensor carpi ulnaris, which should not be isolated from the skin, and should be cut as near its insertion as possible; then the common extensor tendons should be raised, and the whole of the posterior aspect of the carpus denuded until the two wounds communicate freely together; but the radius is not as yet cleaned. The next step is to clean the anterior aspect of the ulna and carpus, in doing which the pisiform bone and hooked process of the unciform are severed from the rest of the carpus, the former with the knife, the latter with the cutting pliers. In cleaning the anterior aspect of the carpus care must be taken not to go so far forwards as to endanger the deep palmar arch. Now the ligaments of the internal carpal bones being sufficiently divided they are to be removed with blunt bone forceps; next, the end of the ulna is made to protrude from the incision, and is sawn off, as low down as is consistent with its condition, but in any case above its radial articulation; the end of the radius is then cleaned sufficiently to allow of its being protruded and removed. If this can be done without disturbing the tendons from their grooves it is far better. If the level of the section is below the upper part of the cartilaginous facet for the ulna, the remainder of the cartilage must be cut away with the pliers. The operator next attends to the metacarpal bones, which are pushed out from one or the other incision and cut off with the pliers, so as to remove the whole of these cartilage-covered portions. The trapezium bone, which was left in the early stage of the operation, is now carefully dissected out, so as to avoid any injury to the tendon of the flexor carpi radialis, or to the radial artery, and the articular surface of the first metacarpal bone is then exposed and removed. Lastly, the cartilaginous portion of the pisiform bone is taken away, but the non-articular part is left behind, unless it is diseased, in which case it should be removed entire. The same remark applies to the hooked process of the unciform. No tendons are divided in this operation except the extensors of the wrist. In order to insure motion of the fingers passive movements should be performed from a very early period after the operation. For this purpose Lister places the limb in a splint with the palm of the hand raised by a wedge of cork fixed below it, so that the joints of the fingers can be moved without taking the limb off the apparatus. When the splint is removed some flexible support is required for some time. I have neither done nor seen this operation; in exceptional cases it appears a good one. (*Vide* Lister's Paper, "Lancet," 1865.)

Excision of the joints of the thumb require no description. A vertical dorsal incision that interferes but little with the tendons of the part may be made. The operation is a very good one; in the case of a man with neglected dislocation in which I performed it, hermetically sealing the wound with lint and the compound tincture of benzoin, rapid recovery followed with a movable joint. In a second case, in which I excised the phalangeal joint of the thumb, a like result ensued.

Amputation in joint disease ought never to be resorted to until all hope of a cure by natural processes has been given up or failed; all minor measures, such as incision, or the removal of necrosed bone, have been deemed unsuitable, excision of the joint is inexpedient or inapplicable, and the progressive nature of the disease and its sapping powers reveal the fact that if the disease be not removed, the life of the patient is likely to be sacrificed. For disease of the hip, shoulder, and elbow-joint, amputation is a very rare operation, and for the knee and ankle it is yearly becoming less common. Yet in proper cases it is a valuable operation, and is the means of saving many lives. The mortality of amputation for chronic knee-joint

disease, at Guy's Hospital, is only one in seven, and in young people under twenty years of age, one in twenty. In amputation for disease of the knee the surgeon should sacrifice as little as possible of the thigh. Where the end of the femur is sound, and the articular facet alone diseased, the amputation should be almost at the joint, the femur being divided only through its condyles. When a larger section of bone is called for it should be made, but only under such circumstances; for it is a truth of recognized value that the mortality of amputations of the thigh increases with every inch of bone removed. In disease of the ankle-joint, when excision and every smaller operation, such as the removal of dead bone, have been put aside, and yet the disease must be removed, Pirogoff's operation or Syme's amputation should be employed in preference to amputation, if the calcis is sound with the integument over it, and the disease of the articular end of the tibia is not too extensive: no more of the body is to be taken away than the absolute necessities of the case demand. To amputate a sound foot for disease confined to the ankle-joint is a measure which is only to be justified by peculiar circumstances; as a practice of surgery it is to be condemned. Amputation of the arm for diseased elbow is still less justifiable, unless the local disease is too extensive to allow of excision, or the powers of the patient are too feeble to allow of the attempt.

CHAPTER LXXVI.

LOOSE CARTILAGES IN JOINTS—OSTEO-ARTHRITIS—SUPPURATION AROUND JOINTS.

LOOSE bodies, ordinarily called loose cartilages, are found in joints. They are most common in the knee, but they are met with in the elbow, ankle, and other joints. They are doubtless as a rule developed in the subsynovial cellular tissue; as they increase in size they encroach upon the cavity of the joint, pushing before them the synovial membrane, and in this condition they may appear as warty or more or less pedunculated fringed growths hanging into the joint. These growths may be single or multiple, and of all sizes up to that of a small walnut. Should one of these masses become detached a "loose cartilage" is said to be present. John Hunter taught, and Rokitansky believed, that they are formed by the organization of fibrinous coagula; but evidence is wanting to prove this view, for most, as pointed out by Rainey, contain ill-formed cartilage-cells and ossific matter, true bone lacunæ being at times present. Paget ("St. Barth. Hosp. Rep.," 1870) has recently given good evidence of the truth of Teale's suggestion, that some of these bodies are really sequestra, and that "just as a blow on bone or tooth may induce necrosis and exfoliation without signs of destructive inflammation, so may it with articular cartilage; and the characteristics of these cases will be that after injury to a previously healthy joint, a loose body is found in it, having the shape and general aspect and texture of a piece of articular cartilage, with or without some portion of subjacent bone, and with its cartilage-corpuscles arranged after the manner of the articular cartilage." Dr. Adams, of Dublin, connects their presence with osteo-arthritis. All these loose bodies, however formed, give rise to very similar symptoms, symptoms produced by the foreign body becoming fixed and pinched between the articular surfaces of the bones. Its presence

is, therefore, usually discovered by accident; when the patient is walking or moving the joint, by some sudden inability to move the articulation, this immobility being attended with a severe and sickening pain, which is only relieved by the cartilage slipping from between the bones, which it usually does by a characteristic snap.

Some stiffness and slight inflammation of the joint may follow this injury to the surface, which will subside in a few days by rest and treatment, again, however, to be renewed upon a recurrence of the accident. These symptoms are very characteristic; but as often as not in such a joint as the knee, the cartilage may be felt on manipulation, although readily slipping away under pressure.

The TREATMENT may be described as palliative or operative. By the former the cartilage is left untouched in the articulation; by the latter it is removed or fixed in an unoffending position. In a general way the palliative treatment is the correct one to be enforced, for knowing how destructive inflammation of a joint following a wound too often becomes, few surgeons would venture upon an operation without an absolute necessity, and such seldom exists, for by restraining the movements of the joint by some leather, felt, or other light casing, the foreign body may become fixed and consequently innocuous, and the limb may be freely used as a stiff one; indeed, by such treatment Hilton has shown ("Guy's Reports," 1868) that these cartilages may become absorbed. He fixes the loose body by means of a pad and strapping at the most convenient spot, and then fixes the limb; by such a practice pain is prevented, for with a splint on, the peduncle of the cartilage cannot be stretched, nor the cartilage slip between the semi-flexed bones. When inflammation of the joint follows one of the attacks of pain, it is to be treated on ordinary principles.

Should, however, the cartilage produce by its presence such serious inconvenience as to destroy the value or use of the joint, whether from the frequency of the attacks, the amount of inflammation that follows, or the dread connected with the affection, some operative interference may be required; but no such should be undertaken till all inflammatory action has ceased, and the joint is in a quiescent state; for this purpose a splint should be applied and worn for at least a week; the loose body should then by manipulation, or by such movement of the joint as the patient from experience knows will bring the cartilage under the surgeon's control, be brought up to one side of the joint, and in the knee its usual seat is to one side of the patella, where it may be fixed with the finger. The surgeon may then draw the skin over it to one side, and cut down directly upon the cartilage, the incision being large enough to allow of its escape. This operation being one by direct incision, the wound should subsequently be accurately closed by a pad and strapping or a pad soaked in compound tincture of benzoin, and the limb kept upon a splint till repair has been perfected.

In cases where direct incision is feared, and this ought to be in all, the removal by subcutaneous incision may be employed: this operation consists in the fixing of the cartilage by means of a grooved needle introduced into its substance through the skin; the introduction of a tenotomy knife beneath the skin down to the cartilage, and the division of all the subcutaneous tissues covering the cartilage in by a free sweep of the knife. The cartilage being then squeezed by the application of strong pressure, or tilted by means of the grooved needle into the cellular tissue of the parts around, a pad of lint should be applied over the spot where the cartilage exists, and absolute rest enforced. A small blister may be applied over the cartilage in the cellular tissue; Syme having found that by such means the foreign body becomes fixed in its new position and subsequently absorbed. To re-

move it by a subsequent operation is a recognized although rarely required measure. Mr. W. J. Square, of Plymouth, adopts the indirect operation, but instead of squeezing the cartilage completely through the subcutaneous wound, he is satisfied by simply pressing the foreign body into the subcutaneous opening and fixing it there by compress and strapping. At the Brit. Med. Assoc. for 1871 he related twenty-four successful cases. I have had but little experience of this operation, but think well of it; the subcutaneous operation is, doubtless, in either of its forms the safer of the two; the direct incision should be reserved for large growths or when the other has failed.

M. Larrey's statistics ("Gaz. des Hôpitaux," No. 67) fairly prove the truth of these observations: Out of 129 cases operated upon by the direct method, 28 were fatal; and only 5 out of 38 by the indirect. He concludes, after a careful analysis of cases, that the operation is a serious one when practiced by direct incision, and a difficult one by the subcutaneous method; that extraction is more dangerous than the persistence of the affection. He believes the operation is indicated by the complete mobility of the foreign body within the joint; the persistence of the accidents caused by its presence, viz., pain, arthritis, and lameness; the failure of acupressure and other means for fixing the position of the body; and the free consent of the patient after having been made aware of its dangers.

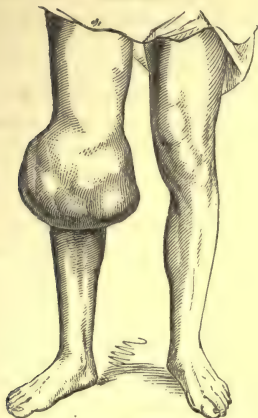
Chronic Osteo- or Rheumatic arthritis.—This is now a well-recognized affection, thanks to the labors of Dr. R. Adams, of Dublin; and in his splendid "Monograph," published in 1857, will be found nearly all that is known upon the affection. Prof. Smith, of Dublin, and Canton, of London, have, however, done much in this subject. It may attack any joint, but seems to be most common in the hip and shoulder; and a large number of cases put up in the different museums as unreduced dislocations are doubtless examples of this affection; the displacement of the head of the bones being the result of the disease. It is chiefly seen in the middle-aged, or old, but occasionally in young people. It is unfortunately called rheumatic, although it has no apparent connection with what is generally called rheumatism. It has probably acquired the name from its chief local symptom of aching pain in the joint aggravated at night and in damp weather. The disease is at first associated with a dryness of the joint, but subsequently with excess of secretion even to a great extent; with some thickening of the bone and expansion of the head of the bones entering into its formation; some eburnation of the articular lamella of bone, with disappearance of its interarticular cartilage after it has undergone the fibrous degeneration; and with what is still more peculiar, the deposition of new crests or plates of bone around the margins of the articular facets and in the ligaments and synovial membrane. These crests often appear as ridges of bone which can readily be made out, and these plates of bone, when the knee is the joint involved, may simulate a second patella. In the case from which Fig. 374 was taken, all these conditions were readily distinguishable; the bones and synovial capsule were enormously enlarged; the ligaments were so stretched as to allow of some lateral movements in the joint; and the characteristic rough, crackling sensation which movement of the joint always gives was most marked.

In still more extreme or neglected cases the end of one indurated bone will in time grind away the end of its contiguous bone, and in Fig. 375 this is well seen; the condyle of the femur has ground down for at least one inch the head of the tibia. The preparation was made from the amputated limb of a man *æt.* 36, the leg having been taken off at the knee-joint be-

cause the limb was a flail, and the joint threatened to disorganize; an excellent stump was left.

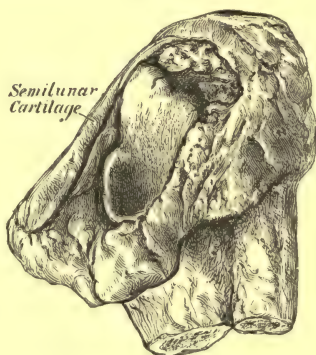
In the hip-joint the head of the bone flattens down, the neck shortens, the cup of the acetabulum becomes saucer-like, and around its margin, as well as that of the head of the femur, an irregular crest of bony out-

FIG. 374.



Drawing 3300.
Osteo-arthritis of knee-joint.

FIG. 375.



Wearing away of the head of the tibia in
osteo-arthritis.

growths will be formed (Fig. 376); the cartilage having gone, and the articular surface of the bones presenting a dense eburnated appearance. In

FIG. 376.



Changes in the head and neck of the femur and in the acetabulum in osteo-arthritis.
Preparation 1131⁶⁰, Guy's Hosp. Mus.

the knee-joint the condyles of the femur, or one only, will be elongated and expanded, the head of the tibia flattened out, the patella enlarged, osteophytes of variable forms and dimensions fringing the margins of the bones. The synovial membrane will also be thickened, and at a late stage of the affection expanded from effusion. The ligaments in this way becoming elongated and the joint dislocated, Adam's "additamentary bones" or new plates of bone of different sizes being found within the synovial membrane, and probably some foreign pedunculated bodies upon its inner surface.

In the early stage the disease is characterized by local pain, stiffness or rigidity of the joint, local thickening and development of bony outgrowths, every movement of the joint giving rise to a characteristic crackling. In the later stage the same pain manifests itself, with thickening, bony outgrowths, effusion, greater mobility, and even dislocation.

I have a lady now under observation in whom this disease is so developed in both knee-joints that the legs are as flails, the bones being enormously expanded and the joints distended, additamentary bones and osteophytes existing.

TREATMENT.—Little beyond attention to the general condition of the patient can be done by way of medicine to check the progress of this affection. In the iodide of potassium we possess a drug that certainly relieves pain, and I have thought retards the progress of the disease, the liquid extract of bark or other tonic being a valuable adjunct. When pain is severe anodynes may be given, such as Dover's powder, or the bromide of potassium in doses of gr. x or gr. xv, this drug going well with the iodide. Professor Smith, who has paid much attention to this disease, thinks well of an electuary of guaiacum, sulphur, the bitartrate and carbonate of potash, ginger, and rhubarb. Dr. Adams prescribes the diluted phosphoric acid. Warm bathing is of use, and the mineral springs of Germany. This disease, although locally a painful one, does not appear to have a fatal tendency, and unless in very neglected cases, rarely goes on to the disorganization of the joint. To maintain rest is not a recommendation to be attended to, for such tends to make the joint stiffen in the early stage of the affection without arresting its progress. In the more advanced stage, when "hydrops articuli" is present, and the ligaments are so loose as to allow of the joint's displacement, some mechanical appliance is called for; it may be in the knee of simple strapping, or of some firm leather, felt, or other casing, this casing being applicable to every joint. In extreme cases amputation may be required.

Acute Bursitis and Suppuration around Joints.—I have placed these two headings together, for there is good reason to believe that suppuration about a joint—that is, in the cellular tissue external to it—is most frequently the consequence of an acute inflammation of some superficial bursa, and that it is only in exceptional instances that such a connection cannot be traced. Over the knee and elbow-joints this suppuration is generally met with, some blow, fall, or punctured wound originating an acute inflammation in the bursæ of these parts, while the thick integument covering them in prevents the inflammatory products making their escape externally, and thus favors their lateral extension: the abscess in neglected cases burrows so as to pass backwards into the popliteal space after covering in the knee, or comes forwards in the arm into its flexure; more commonly, however, it shows itself as a painful phlegmonous inflammation over and around the patella or olecranon process. In some examples the suppuration is confined to the bursa, and in most the inflammation will be found to radiate from these well-known points. In children, however, the connection between the suppuration and bursitis is not so readily made out, and there can be little doubt that, at times, no such exists.

The severe cases of suppuration around a joint are most frequently met with in children of delicate and feeble frames; in badly fed children who are disposed to rapid extension of suppurative inflammation when started by any slight accident, blow, fall, or strain. It is not uncommon to find these large abscesses around the shoulder, a joint that is less liable to disease than any other; but in children it is frequently the seat of suppuration of the cellular tissue, which at times extends to the articulation, and

is probably caused by some strain or injury, when the child is dragged along by a careless or violent companion; it may be that the muscles of the parts are injured; at other times it is the epiphysial cartilage placed between the epiphysis and shaft which has suffered.

The diagnosis of these cases of suppuration external to the joint is not difficult. On examination, it will be seen that the swelling is external to the joint, covering in the well-known points of the bone; in the knee probably the soft parts will be raised from the patella, and fluctuation will be felt above and around it. There will be much local pain, but not so much constitutional disturbance as would exist with a suppurating joint; the joint, moreover, would be capable of some amount of movement without pain, a condition which would be impossible if the seat of the disease were in and not around it.

TREATMENT.—There is but one form of treatment upon which reliance can be placed in these cases of suppuration about a joint, and that consists in giving free exit to the pus. A free incision should be made into the abscess as soon as any pus can be detected. The limb should be raised, the joint preserved at rest by pillows or splints, and warm water-dressing or a poultice applied. When the powers of the patient are feeble, tonics should be given. The joint should be kept absolutely quiet till repair has been completed. When the abscess is not opened early, it may open into the joint and produce an acute suppuration. I have known this happen in the knee with a fatal result. In the knee it is often necessary to make a free incision over the patella, as well as on either side of the joint, to prevent burrowing.

CHAPTER LXXVII.

DISEASES OF THE BONES.

IN a pathological sense, diseases of the bone are identical with diseases of other tissues; such differences as exist are due to the anatomical and physiological peculiarities of the bones; diseased action, under all circumstances, being materially modified by texture. In the bones, diseased action is thus modified by the presence of the inorganic material which they contain, two-thirds of their constituents being earthy, and one-third animal. This animal texture includes a fibrous periosteal membrane, with cellular tissue beneath, in which the vessels which surround the bone ramify, and a finer endosteal membrane which lines it, the two membranes being intimately connected together by delicate vascular and membranous links permeating the Haversian canals and canaliculi of the bone itself. The exterior of the bone is dense, and derives most of its nourishment from vessels ramifying in the periosteum. The interior of the bone is porous or cancellated, and derives its supply of blood from a distinct nutrient artery which runs in the endosteum, the capillaries of both anastomosing freely through the bone canals. The long bones are also built up of shafts (diaphyses) and epiphyses; these epiphyses being distinct from the shafts during the early years of life, and having their own vascular supply. The shafts and epiphyses are connected together by means of a layer of epiphysial cartilage, through which, as proved by Professor Humphry, the shafts grow. The epiphyses themselves are covered with articular cartilage, that derives its nutritive supply from them. These anatomical points, thus briefly sketched,

are important to remember when the pathological are considered, for most of the peculiarities of bone disease are to be explained by them. Thus, when a bone inflames, it can only do so through its soft tissues, its inorganic matter being affected secondarily. The periosteal and endosteal membranes being intimately connected, inflammation originating in one is very liable to extend to the other, and in proportion to the nature or amount of this extension will the inflammation be periosteal or endosteal—either one of periostitis or osteitis.

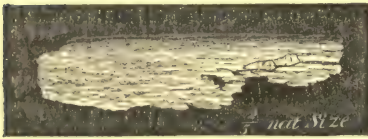
In long bones, when disease attacks the shaft, it may become arrested by the epiphysis or epiphysal cartilage, the articular ends of the bones escaping, and, as a consequence, the joints. In periostitis, however, such a result is not always secured, for the synovial membrane of a joint, in a clinical point of view, may be regarded as a continuation of the periosteum, and pus beneath this membrane may burrow into the neighboring articulation, or the inflammation may spread by continuity.

With these remarks the diseases of bones may be considered, dividing them into the inflammatory affections, with its modifications, tumors of bone, atrophy, hypertrophy, rickets, and mollities ossium; looking at first at bone, as a whole, and, in a subsequent page, as made up of parts.

Inflammation of bone may be divided into the *acute* and the *chronic*.

The *acute* is generally idiopathic—unless it follows the division of a bone by operation or compound fracture—and ends in diffused suppuration, and the death of the bone, more or less, complete; when originating in the periosteum, and not wholly involving the endosteum, the outer surface of the bone may alone die; when originating in the endosteum, and not wholly involving the periosteum, the inner portion of the bone may die and the shell escape; the whole bone dying when both membranes have been equally involved, whether commencing in one or the other. The extent and depth of the destruction of bone, or its “necrosis,” is determined by the extent and intensity of the inflammatory action, and the degree in which the membranes covering and lining the bone have been involved.

FIG. 377.

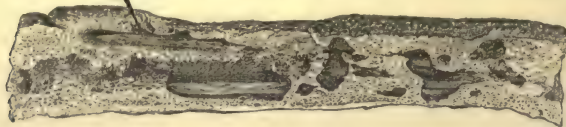


Periosteal necrosis.

Thus, on the one hand, Fig. 377 represents a large shell of bone which exfoliated from the tibia after an acute periostitis; Fig. 378, a sequestrum, the result of an endostitis, osteomyelitis, or osteitis—for all these terms are

FIG. 378.

probe touching bone through Cloaca



synonymous—surrounded by a shell of new bone newly formed by the periosteum; and Fig. 379 illustrates the appearance of the limb so affected, taken from life.

In Fig. 380 is seen a bone which has died, nearly as a whole, from inflammation of both membranes, no new bone having been formed on its

upper surface where the periosteum has been completely destroyed, although at the lower part, where the membrane was sound, bone has been renewed.

FIG. 379.

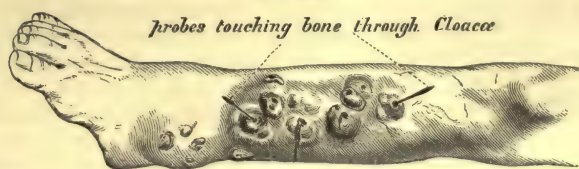
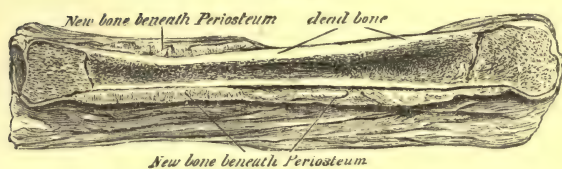


FIG. 380.

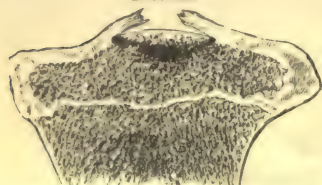
Necrosis of tibia. Prep. 1243^{ss}.

But this death of the bone, or necrosis, is not the inevitable result of all inflammation, although of an acute suppurative inflammation, it probably is. In more chronic cases other changes occur, and in the articular extremities of the bones, or in the spongy bones, they are well seen; they may be described as follows, quoting my own words, written in 1859 (on diseases of joints): In the earliest condition simple vascularity will be the principal morbid appearance, the cancelli containing more serum than natural; we shall soon, as the disease advances, observe that the articular extremity of the bone is larger than natural, this enlargement being, in some cases, very great. Upon making a section of the bone, the saw will break through its structure more easily than in a healthy specimen, its earthy constituents having diminished. Upon comparing the structure of the diseased bone with a healthy specimen it will be observed that its cancelli are much enlarged, the columns radiating from the shaft in a palm-like fashion, as if they had been spread out from downward pressure. These cancellated portions of the bone will appear more vascular than natural, and the cancelli will probably contain some pinkish serum. If the inflammatory process is of a tolerably healthy character, parts of the bone will appear denser and more indurated than the remainder, evidently from the organization of the inflammatory deposit, this deposit in bone always becoming osseous; frequently, however, suppuration and necrosis, or death of the bone, is the result, and a small or large sequestrum, a local or diffused abscess will be seen. If we examine the denser portion of the bone forming the shell, it will be found thinner than natural; it will appear as if it had been dilated, even crackling on firm pressure. Where the articular extremity joins the shaft some new bone may be detected, thrown out, as it were, to support its dilated body. The articulating surfaces will in some parts appear more vascular than normal; in other cases, more advanced portions will be found loose and lying in the joint, having been thrown off like a slough; the denser portions of bone dying more rapidly than the cancellated.

In this way the cartilages undergo more or less rapid degenerative

changes, and joint disease makes its appearance, the cartilage thinning from its bony attachments more or less rapidly, or being cast off as a slough, or shed as a nail or cuticle.

FIG. 381.



Necrosis of the articular lamella of bone with degeneration of cartilage covering it in.

In the drawing annexed (Fig. 381) these changes are beautifully seen. In the shaft of the bones these changes are also equally manifest, the bone expanding in the early stage, and becoming more porous, in the later more dense from the organization of the inflammatory exudation, sometimes becoming in old cases like ivory. (Fig. 382.)

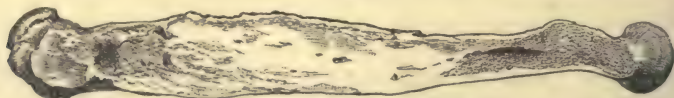
In local periostitis a small portion of bone may alone die, and, as Sir James Paget has shown ("Clinical Rep.," 1870), remain quiescent under a puffy or suppurating swelling.

In some cases of endostitis or osteitis, when the periosteum is not morbidly involved, a layer of new tissue is poured out between the bone and periosteum, being secreted from the latter; it is at first soft and fibrinous, subsequently hard and osseous, this new matter being clearly reparative in its nature; in fact, it is the material from which the new bone will be formed. In the period before it becomes osseous it can readily be peeled off the bone by means of the handle of a scalpel or a periosteal elevator. It is to this tissue M. Ollier alludes when he recommends the subperiosteal resection of the shaft or articular ends of bones, for it is upon such mainly that the regeneration of a bone or part of a bone depends. It may be only a few lines in thickness, at times it is half an inch. Analogous changes go on in the endosteum or medullary membrane of the bones to those described as going on in the periosteum, although they are not so well seen. The products, therefore, of a periostitis or endostitis vary with the character and intensity of the inflammatory process, precisely in the same way and under the same conditions as the products of inflammation vary in the softer tissues. In very intense inflammation and in subjects of low power the death of the inflamed parts is the result; of the periosteum, with the bone depending upon it for its nourishment; of the endosteum, with its bony fabric; or of the whole bone when both membranes are equally involved.

When suppuration takes place, it may occur as a diffused abscess in and around the bone; when in the bone it is known as osteo-myelitis or endostitis; when around it as periosteal abscess, a state of affairs which is mostly followed by necrosis, more or less extensive; or as a local abscess in the bone, with or without a centre of dead bone, necrosed bone, known as a "*sequestrum*."

In chronic cases in subjects of better power, the bone will expand and then thicken, the inflammatory effusion undergoing organization; the bone becomes solid and dense; this is known as sclerosis (Fig. 382). In some cases it may subsequently die.

FIG. 382.



Sclerosis of bone. From Prep. Guy's Mus.

But necrosis in a general way is a more rapid act, and is the direct result of the first onset of the inflammation; what is regarded as the chronic action is a reparative one, the effusion and organization of new bone-forming

material, the separation of the dead bone from the living being generally a slow process.

As a guide to the seat of the inflammation and suppuration in acute osteitis or periostitis, the character of the pus is of essential importance; in periostitis it differs in no respect from the pus found in other tissues, but in endostitis, osteitis, osteo-myelitis, the pus is mixed freely with oil-globules. In a striking case, which occurred in a girl *æt.* 10 recently under observation, the surface of the fluid evacuated after a free incision down to the tibia was covered in with oil-cells. Roser has made a like observation. After these general remarks the clinical symptoms of the different conditions will now claim attention.

Acute inflammation of bone, whether periosteal or endosteal (osteomyelitis), is a very grave affection; it is mostly found in young subjects before puberty, during the growth of bone; and is as often as not the result of some local injury or exposure; in many cases no local exciting cause can be made out. It is usually met with, however, in feeble and cachectic subjects, and in those termed scrofulous. It is most common in the shafts of the long bones, and in those which are most exposed, such as the tibia; although it is almost as frequently seen in the femur. The bones of the upper extremity are more rarely affected than those of the lower.

The disease is sometimes ushered in with a deep aching pain in the bone, but more frequently with intense fever and constitutional disturbance, increase of temperature, often with a rigor, and the affected bone is exquisitely painful. When the articular end of a bone is the seat of disease rheumatic fever is sometimes supposed to be present. The pain in the limb is speedily followed by swelling evidently deeply placed, but not by any external evidence of inflammation such as redness; as the swelling increases the soft parts covering it become tense, sometimes œdematous; the veins of the part look full, indicating deep-seated obstruction; any attempt at movement or pressure causes suffering.

When the disease is periosteal in its origin the skin will soon become involved, and some local redness will appear, the slightest touch exciting pain. When endosteal at the onset many days will pass before any external signs of inflammation show themselves, and gentle manipulation will be allowed. Redness and other external signs of inflammation appear only when the disease has spread to the periosteum, and through it to the soft parts around. When suppuration ensues the skin from being tense and œdematous becomes inflamed; the constitutional disturbance becomes worse; sleeplessness, and probably delirium with a feeble pulse appear; rigors become more frequent, pain is more intense, and unless relief be afforded by a free incision down to the bone, death by exhaustion and probably blood-poisoning is apt to occur. There is a close connection between acute inflammation of bone and septicæmia. (*Vide* Chapter II.)

When the inflammation is essentially *periosteal* the fluid effused is pus more or less well formed; it may be mixed with blood. When endosteal, and in feeble subjects, it may be only a blood-stained serum containing lymph. In the worst case I have seen of this disease, in the femur of a girl, this effusion was very copious. When it occurs blood-poisoning is peculiarly apt to take place. When pus is mixed with oil-globules, as previously stated, the endosteum is involved. As a consequence of this affection necrosis will occur. When periosteal in its origin the outside shell of bone may alone die. When endosteal the periosteum is sure to be implicated, and the greater part if not the whole shaft of the bone will become necrosed.

Endostitis is far more serious a disease than periostitis, whether as a pri-

mary affection or consecutive to the latter, it being particularly prone to be accompanied by blood-poisoning.

This acute osteitis, periostitis, or endostitis, may attack the cranial bones, carpal and tarsal bones, articular ends of bones, epiphyses or phalangeal bones; and when it does it may end in the complete death of the bone, or of its centre or shell, according to its seat or extent. In the ungual phalanx of the fingers is seen the best instance of death of the bone from periosteal inflammation, the bone dying as a whole without any attempt at its re-formation, some five or six weeks after the first onset of the inflammation. Such cases are generally, but wrongly, looked upon as *whitlows*. In the tarsal bones it is most common in the os calcis, and large sequestra are commonly met with in this bone; periosteal necrosis is, however, comparatively rare in the calcis, except as a result of injury to its tuberosity.

When this disease attacks the articular ends of the bones, acute joint disease is the general result. As a consequence of division of bone, whether by amputation, resection, or after compound fracture, gunshot or otherwise, this endostitis, more commonly called osteo-myelitis, is a common cause of death, and too frequently the precursor of septicæmia.

Fayrer, of Calcutta, in his "Annals of Med. Science," 1865, has drawn attention to this fact. He looks upon the prominent fungous mass of granulations that is often seen covering the end of the amputated bone as indicative of the affection, and the facility with which the surgeon passes a probe well into the medullary cavity through these granulations establishes the diagnosis; the general symptoms being pain in the part, œdema and swelling extending down the limb, general fever, with quick pulse and increased temperature, and more especially the recession of the soft parts, including the periosteum, from the bone, which is then left denuded at the bottom of the wound.

Jules Roux, of Toulon, first drew attention to this affection, and gave it the name osteo-myelite; it is, however, essentially an endostitis, only of traumatic origin.

TREATMENT.—In all cases of acute disease involving bone, when effusion takes place, and is confined beneath the dense fibrous periosteal layer, there is no treatment equal to that of a free incision down to the bone; and if the disease be not arrested or modified by such a practice, immense relief to pain is rapidly afforded. There is good reason to believe, however, that by such treatment the disease is often limited, and even arrested, the death of the bone being averted in some cases; for bone, as other tissue, is doubtless very prone to die when subjected to the compressing influence of a confined effusion.

When the upper part of the shaft of a bone, or the articular end of a bone, is the seat of disease, this practice is very important. There is no need to wait till pus has formed, for to do this is generally to wait too long. The object of the incision is to relieve tension, and it should be carried out as soon as tension clearly exists. In one case that occurred to me of acute disease of the tibia I opened the periosteum on the fourth day, before any external evidences of inflammation showed themselves beyond turgid veins and bone enlargement, with severe local pain and constitutional disturbance. The incision gave vent only to bloodstained serum, but it was followed by immediate relief to all local and constitutional disturbance, and a rapid recovery took place. In this case all evidence pointed to endosteal rather than periosteal inflammation, and yet the bone was saved.

If the incision does not save the bone, it relieves symptoms, and when the shaft of a bone is involved the pus will often be prevented from burrowing beneath the periosteal membrane into the neighboring joint, and

thus the disease is limited. Indeed, this liability to joint complication is one of the strongest arguments in favor of the practice. When it ends in necrosis it will have to be treated according to the mode to be referred to in a later page. Billroth believes that one of the most efficient remedies is painting the affected limb with strong tincture of iodine till vesications form, fresh iodine being applied as the vesicles dry up.

The limb should at the same time be elevated, and hot fomentations applied, pain being relieved by opium, morphia, chloral, or any other sedative, and the general power kept up by abundance of nutritious food, such as milk, but stimulants should be cautiously administered.

Abscess in Bone.—Abscess in bone is the result of a local inflammation, and it may or may not be associated with the death of a small piece of bone. It is in some cases acute, but more generally chronic. To Sir B. Brodie's paper, published in 1846, the profession is indebted for the best account of the chronic affection.

There is an *acute abscess* in bone and a *chronic*. In the *acute* some necrosis is generally associated with it; in the *chronic* such an association is rare.

Not long ago I treated a boy, *æt.* 17, who was seized with intense pain in the head of his tibia, followed in three days with local swelling and acute constitutional disturbance—which had been looked upon as that of rheumatism—in whom, at the end of a month, I made a free incision down to the bone to relieve pain, and give vent to any pus that might have found its way externally. A week later pus appeared, evidently from the bone, for a probe could be passed through the wound into a cavity. In the sixth week from the commencement of the symptoms I enlarged my opening, and through the aperture in the head of the bone from which the pus had flowed I removed three pieces of bone—together making a piece the size of a nut—which rested in a cavity lined with lymph and velvety granulations so characteristic of an abscess. A complete recovery ensued. In another boy, *æt.* 16, I removed a similar piece of bone from a like cavity in the end of the radius which had been preceded by similar severe local and constitutional symptoms: in both cases acute inflammation of bone had ended in the formation of a local abscess, with circumscribed necrosis, and recovery rapidly followed the surgical treatment.

Some few years ago also a child received an injury to the tibia from a pin, a playfellow having attempted, when the child was asleep, to drive it into the bone. Nothing beyond some slight local pain followed the injury for a few days, when severe symptoms appeared, such as pain and swelling with fever, &c. I cut down upon the part with a view of relieving pain, and in doing this the point of my knife went with a crackle through a thin layer of bone, giving vent to a teaspoonful or more of pus; the operation was rapidly followed by recovery.

These three cases are enough to indicate the fact that acute abscess in bone is met with, with its symptoms and treatment.

Chronic Abscess.—In 1773 William Bromfield, surgeon to St. George's Hospital, wrote in his "Chirurgical Observations"—"Whenever a patient complains of a dull, heavy pain, deeply situated in the bone, possibly consequent to a violent blow received in the part some time before, and though at the time the patient complains of this uneasiness within the bone the integuments shall appear perfectly sound, and the bone itself not in the least injured, *we have great reason to suspect an abscessus in the medulla.*" In 1824 Sir B. Brodie amputated a limb for incurable pain in the tibia, and in this case—which Sir W. Fergusson has described "as one of the beacon lights of surgery never to be forgotten"—wrote Brodie, "the lower

end of the tibia is enlarged, and the surface presents marks of great vascularity; the bone in the preparation is divided longitudinally, and just above the articulating surface there is a cavity as large as a small chestnut. This cavity was filled with dark-colored pus. The inner surface of it is smooth. The bone immediately surrounding it is harder than natural."

In these two extracts, written at an interval of fifty years, are embodied the clinical and pathological facts connected with the subject which are now recognized by surgeons.

This chronic abscess is generally met with in the articular ends of bones, that is in cancellous tissue, more particularly in the two ends of the tibia.

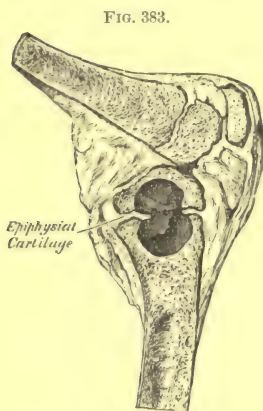


FIG. 383.
Abscess in head of tibia; disorganization and dislocation of the joint. Prep. Guy's Hosp. Mus., 1245⁹⁰.

I have, however, seen it in the condyle of the femur and the humerus, in the shaft of the ulna, and of the radius, and shaft of the tibia. It may, however, occur in any bone. In Fig. 383 the cavity of such an abscess is illustrated, and in Fig. 354, its opening into the joint. The history is generally obscure, an injury at times being its assigned cause. The most characteristic symptoms are a fixed, dull, aching pain in the part, with exacerbations, the pain being then acute and fixed, of a burning pulsatile kind, "like the falling of drops of molten lead," as a patient once described to me; local circumscribed tenderness or pain on firm pressure; and probably some evident enlargement of bone, and the sense of local heat.

In more advanced cases the soft parts over the bone will be œdematous, and on firm pressure over the painful spot a sensation of yielding will be given to the finger. In still more neglected cases the abscess may make its way into

a joint; under fortunate circumstances it may advance forwards and discharge itself externally.

TREATMENT.—The nature of the affection being made out, its treatment is not complicated, for nothing less than the opening of the abscess in the bone is of any use. This is usually to be done by means of the trephine, a small one being used. After the soft parts have been turned back by a crucial incision, the trephine should be applied over the painful spot—this having been marked before the patient is anæstheticized—and the bone well perforated. When the instrument has opened the abscess, pus will at once well up; it should then be removed, the ring of bone raised by the elevator and taken away; the cavity is rarely very large and the pus is seldom above a drachm, although at times there may be more. The cavity is generally lined with smooth velvety granulations. After this operation the parts have only to be left alone to heal, recovery being very constant.

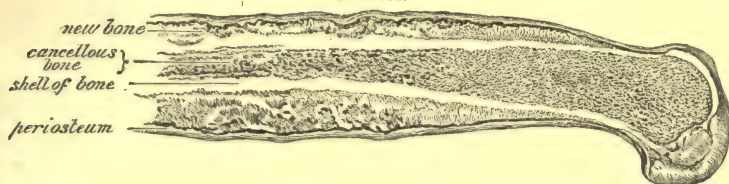
It is not, however, always necessary to trephine a bone; a less severe operation is at times of equal value, and that is its simple puncture by means of a drill, and when the seat of the abscess is not very accurately defined the drill is probably the better instrument to use. In a striking case I had in the spring of 1870 I carried out this operation. Having punctured the head of the tibia of a man who had all the external evidence, such as bone expansion, &c., of local osteitis and suppuration, I cut down upon the expanded painful part, and made two punctures with a drill, one of the punctures having clearly gone into a cavity in the bone, as evinced by the sudden loss of resistance. No pus, however, was seen at the time to

well up in the wound, although after the operation a free discharge took place from the wound; the operation was followed by complete relief from all pain, and in a month the man left Guy's well, and three months later he still remained so.

This operation of drilling the bone seems to me to be a good one, both for supposed suppuration as well as for osteitis (chronic); it is less formidable than trephining, and may be done in cases where the latter is inapplicable, or will not be entertained; indeed, the two means may be employed together when the trephine has failed to open the abscess. Holmes's suggestion to pierce the walls of the trephine-hole in several directions with a sharp-pointed instrument, in order to remove the bone freely with a chisel, if a drop of pus follow any of these punctures, is quite consistent.

Chronic Periostitis and Endostitis.—Chronic *periostitis* and *ostitis* are very common affections, the shaft of the long bones being particularly liable

FIG. 384.



to be thus affected. The latter is probably the more common of the two, pure periostitis, unless from syphilis or injury, being comparatively rare. These affections may be modified by syphilis, scrofula, or rheumatism. They may originate from some local cause or injury, but in all, their course is much the same; the disease varying only in the rapidity of its progress, extent of its influence, and results. In one case complete recovery takes place, the effusion being reabsorbed; in another the effusion organizes as a superficial node or bony outgrowth (Fig. 384), or as an enlarged, elongated area of dense bone (Fig. 382); in exceptional cases local suppuration takes place, giving rise to a chronic periosteal or endosteal abscess, whilst in a large proportion the bone dies wholly or in part, and thus gives rise to *necrosis*. In some few the bone, either upon its surface or interior, undergoes a chronic disintegrating process, which is known as *caries*.

The symptoms of chronic periostitis and osteitis (endostitis) are in their nature very similar to those of the acute, although less severe, a dull aching pain in the part, of a persistent kind, aggravated at intervals and on hanging down the limb, being the most constant, and the pain being almost always worse at night. In syphilitic affections this symptom is very general. The constitutional symptoms will vary according to the severity of the local condition; febrile disturbance and intensity of local action run hand in hand.

In *periostitis* the pain is generally local and attended with swelling at an early period of the affection, indeed within a few days of its onset. In *endostitis* the pain is generally more diffused through the whole bone, and will continue for weeks or months without any external evidence of enlargement, being too often regarded as "rheumatic" or "growing pains." In *periostitis* tenderness on manipulation is an early and constant symptom. In *endostitis* the bone may be manipulated with gentleness without exciting pain; firm pressure, however, almost always causes suffering.

In *periostitis* the enlargement generally shows itself as a bossy swelling

on the surface of the bone, or as an undulatory one—as one, two, or more nodes upon the bone; syphilitic periostitis being generally multiple and undulatory, traumatic and other forms of nodes being usually single. In *endostitis* the enlargement appears as a general expansion of the bone in all directions; in rare cases as a distinct *elongation of the bone*.

In *periostitis*, when suppuration is about to take place, external evidence will appear in the form of increased swelling and tenderness, redness of the skin, cedema of the tissues covering in the node and fluctuation will be present. In *endostitis* terminating in abscess there will be a great aggravation of all local pain, with constitutional disturbance, and often rigors; cedema of the soft parts over the bone and external evidence of inflammation will rarely appear, and then only when the abscess is making its way through the periosteum externally (*vide Abscess in Bone*).

When *periostitis* ends in necrosis it is only of the shell of bone beneath the inflamed node (peripheral necrosis). When *endostitis* ends in necrosis it is usually of a greater or less mass occupying the centre of the bone (central necrosis); sometimes the whole shaft or articular extremity dies.

In *periosteal* necrosis the dead bone rests exposed, and when covered in it is by soft parts alone, no new bone surrounding it (Fig. 377).

In *endosteal* necrosis the dead bone or sequestrum is more or less completely surrounded by new bone—a new periosteal formation (Fig. 378). When this is incomplete, it is a fair proof that the periosteum has been involved (Fig. 380).

In necrosis of a long bone the result of periostitis, and endostitis by extension, the hope of a new bone being formed is a forlorn one; whilst in the necrosis of endostitis there is every hope of a complete restoration of the bone taking place, through its periosteal covering, on the removal of the dead portion or sequestrum.

In the *necrosis of the skull*, which is always periosteal, no new bone is formed, the bone-forming membrane, the periosteum, having been destroyed. When following an injury to the skull it is preceded by “the puffy tumor of Pott.” In syphilis it follows a suppurating node.

In a rare, if not unique preparation (Guy’s Museum) of necrosis after amputation, taken from a patient of my own, the end of the divided femur died, and, at a later period, the periosteal sheath of new bone that formed around it died also, one sequestrum being found within the other on their withdrawal from the stump.

TREATMENT.—In *periostitis*, when suppuration does not take place, fomentations, with the elevation of the limb, sedatives to allay pain, and the internal use of the iodide or bromide of potassium, with or without tonics, according to the special requirements of the patient, are the most efficient means; in still more chronic cases the use of a blister, or the repeated application of the compound tincture of iodine, is of value. When rheumatism seems to influence the morbid action, colchicum has a beneficial tendency. When nocturnal pain is great, besides the internal administration of opium or other sedatives, the external application of belladonna certainly gives relief; when unrelieved by such treatment, and severe, a subcutaneous section of the periosteum with a tenotomy knife is a reliable operation. When suppuration threatens, the application of a poultice or hot fomentation, with or without the application of leeches, may sometimes arrest it; a blister at times seems to check its progress. When pus has formed, as a rule it is wise to let it out, but the surgeon need be in no hurry to do this unless pain be great and the abscess has a disposition to spread, for pus may be reabsorbed, and opening a periosteal abscess renders bone exfoliation more probable. Some German surgeons have

great faith in the repeated local application of iodine to check inflammatory action and hasten the absorption of pus.

Chronic osteitis is an affection which is most troublesome to treat with any effect, and the same means that have been recommended for periostitis may be tried in this. In a general way, however, they do little more than give relief; they have but slight effect upon the progress of the disease, it being far too common for a bone chronically inflamed to become necrosed. When treated early, however, the success is not unsatisfactory. When the disease is steadily progressing, and remedies appear to have no influence on its progress, the operation of drilling the bone in one or more points, according to the extent of the disease, is an operation to be recommended; and when this fails that of trephining may be employed, for taking away a piece of bone or drilling the bone, if it does not avert the progress of the disease, which it undoubtedly often does, at any rate gives relief to local pain. Pain in endostitis or periostitis is due to tension caused by pent-up inflammatory effusion, whether fibrinous, purulent, or serous, and relief can only be afforded by its removal. When a new growth, cystic or otherwise, occupies the centre of a bone, a like pain is however experienced.

Necrosis means the death of bone; it may be of the shell or compact tissue, of the inside or cancellous tissue, or of both combined. It may occur as a result of periostitis or endostitis; or idiopathically without known cause, or follow fever, or be the result of injury from sprain, concussion, contusion, fracture or gunshot wound. As a consequence of acute inflammation, bone may die rapidly. I have already related a case in which local necrosis of the articular extremity of the tibia took place in six weeks, and it is well known that phalanges necrose and exfoliate in five or six; in fact, in acute necrosis a month or six weeks is full time for bone to die and be thrown off. In the necrosis of the lower jaw from phosphorus the same truth is exemplified. Necrosis as a consequence of chronic inflammation is less rapid and certainly less common, for when a bone dies from inflammation it does so usually from acute action; the chronic action being shown in the process of exfoliation, in the separation of the dead bone from the living. Here a considerable time is often expended; no definite period has been hitherto recognized, the rapidity of the process differing in every case.

The process of exfoliation is a very beautiful one; it is the same in bone as in the soft parts, only slower.

"When a portion of bone is to die," writes Holmes in an admirable article in his "System," vol. iii, "the first phenomenon is the cessation of circulation in it. This leaves it hard, white, and sonorous when struck. It does not bleed when exposed or cut into, and is insensible. Occasionally, when the dead bone is exposed to the air, and acted on by the presence of putrid pus, its color becomes nearly or quite black; large surfaces of hard, black, necrosed bone are sometimes left exposed by the sloughing of the skin over the tibia. The dead bone at first retains its connection to the bone around, as well as to the periosteum or whatever part of the nutrient membrane may belong to it; but the presence of a dead part is never long tolerated by the living tissues, and accordingly the processes which are to eliminate it soon become perceptible in both these structures. The periosteum or medullary membrane, as the case may be, separates from the dead bone and becomes inflamed, a quantity of ossific deposit (more or less, according to circumstances) is poured out between it and the dead bone, and this deposit soon becomes converted into new bone, forming a sheath over the dead portion, by which the latter is inclosed or *invaginated*, as the technical term is. The dead part is now called a *sequestrum*, a name only properly applied to it when loose and invaginated, though often incorrectly

used of any piece of dead bone. While this sheath is being formed from the membrane coating the dead bone, changes are going on in the living bone to which it was attached. When the latter has been previously diseased, *i. e.*, when the necrosis has been of inflammatory origin, the inflammatory deposit which surrounds the sequestrum softens, pus is formed, and a groove of ulceration is produced at the expense of the circle of inflamed bone which forms the margin of the sequestrum. If the surrounding bone has been previously healthy the sequestrum acts as an irritant upon it, setting up first inflammation and thickening to a variable distance, and then ulceration. Thus a groove is traced round the sequestrum, and the formation of the groove is accompanied by suppuration, 'the pus containing much earthy matter from the disintegrated tissue, B. B. Cooper stating $2\frac{1}{2}$ per cent. of phosphate of lime.'" "The pus formed in the neighborhood of the dead parts makes its way to the nearest surface, and in so doing interrupts the formation of the periosteal sheath, leaving sinuses or *cloacæ*, passing through this sheath from the sequestrum to the surface of the body, or sometimes into a neighboring joint or serous cavity. The presence of such sinuses leading through the shell of bone to hard, smooth, sonorous bone at the bottom of the cavity is the distinguishing mark of necrosis." (Fig. 379.)

Where the periosteum has been destroyed no investing sheath of bone will exist to interfere with the separation and casting off of the sequestrum (Fig. 380); where it is nearly perfect the shell of new bone will be complete (Fig. 378). Under these circumstances the casing thickens and becomes dense. I have in the thigh cut through a bony sheath upwards of an inch in thickness to reach the sequestrum. The subperiosteal sheath is never seen in necrosis of the skull, or in short cancellous bones.

The whole shaft of a long bone may become necrosed, or any portion, the epiphyses saving the joints (Fig. 380); but as a rule some portion of the shaft remains attached to one or other of the epiphyses. Occasionally the epiphyses themselves are the seat of necrosis. In the tarsal bones, during infant life, the ossific centre of the bones may die and exfoliate. There is also good reason to believe that necrosis of the shaft of a bone often originates from inflammation in the epiphysial cartilage connecting it with the epiphysis after a sprain or injury.

The amount of thickening around the sequestrum depends much upon the extent of new bone poured out by the periosteum, and the duration of the process; its density also turns upon the length of time the sequestrum has been invaginated, and the character of the inflammation. The bony shell in its early condition is soft and readily cut, broken down, or peeled off; in its later stages it becomes as hard almost as ivory, and is most difficult to cut through.

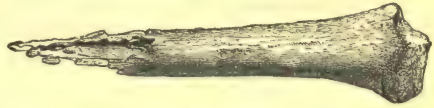
When the *cloacæ* of the bone case are large and fortunately placed towards the end of the sequestrum, natural efforts may be sufficient of themselves to get rid of the foreign body, the granulations filling the cavity gradually pressing upon the dead bone, and mechanically extruding it from its bed. In this way large masses of bone are sometimes discharged by natural processes. After amputation this result is frequently seen. Some years ago I saw with Mr. Cock and Dr. Iliff, of Kennington, a case in which the upper part of the shaft of the humerus which had separated at its upper epiphysis was gradually pressed out from below through the deltoid muscle, and projected outside the acromion process for about an inch; Mr. Cock had only to complete the process which nature had so well commenced, and draw out the bone, which was four inches long (Fig. 385).

Every surgeon is familiar with a somewhat similar act in other cases

where large pieces of bone are sometimes discharged by natural processes, and far more frequently small ones; but such successful natural efforts are rare in comparison with the failures, surgical art being, as a rule, demanded to assist a cure.

When the dead bone has been shed or the sequestrum extruded by natural efforts or removed by surgical art, the bone granulates and thus heals. When this process takes place upon its surface the steps are very visible. When the sequestrum has been removed from a cavity the same process goes on; but with it another acts with equal force, and that is the gradual contraction of the periosteal shell of new bone that surrounds the sequestrum; in this way a bone is re-formed and repaired.

FIG. 385.



Prep. 1104⁶⁰.

TREATMENT.—When dead bone has been made out to exist by means of the symptoms already mentioned, its removal is the only sound practice. The longer dead bone is left in its cavity the thicker and denser becomes the periosteal bone sheath, the probabilities of a natural cure consequently are less hopeful, and the difficulties of a surgical operation greatly increased. The sequestrum cannot, however, be taken away until it has been thrown off from the living tissues or loosened; but as soon as this result has taken place the sooner the operation for its removal is performed the better. To interfere too soon before this process has been completed is sometimes injurious, and always futile. To wait too long is simply to add to the difficulties of the case and postpone recovery. Bones that are not loose may, however, often be detached by a good twist of a pair of forceps, or raised by an elevator.

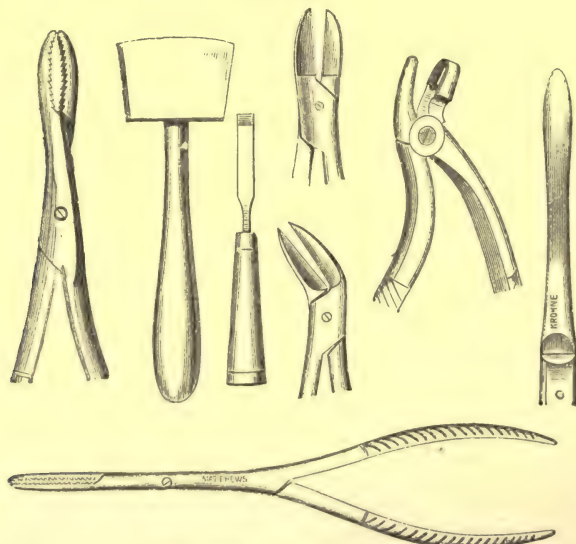
When the dead bone is felt to be loose by means of a probe, that is when it can be made to move in its sheath, there can be no hesitation on the part of the surgeon about interfering; but when this movement cannot be made out the same treatment may be justifiable, for the sequestrum may be so tightly impacted, so shut in by granulations, as to be immovable and yet be loose. Under these circumstances the history of the case and the duration of the disease will be of great importance as a guide, for where many months have passed since the inflammation that killed the bone set in, the probabilities of the sequestrum being loose are great, for most sequestra are shed in four, five, to ten months. I have seen a sequestrum in acute disease thrown off in six weeks, and have removed a large portion of the shaft of the tibia three months after the first onset of the symptoms; whilst, on the other hand, the dead bone may be found fixed at a far more distant date than that named. All surgeons know that a necrosed phalanx is generally loose at the end of five weeks, and is ready for removal, and in most cases the surgeon is justified in performing the operation for necrosis (sequestrotomy) within the year. English surgeons, as a rule, are disposed to wait till the evidence of the sequestrum being quite loose is clearly marked, few caring to interfere before; whilst many Continental surgeons, and particularly the Germans, excise the diseased bone within three months of its first manifestation of disease, by what is called a subperiosteal operation, that is the peeling off of the periosteum with its bony sheath, and the resection of the shaft of inflamed, dying, or dead bone. But in doing this, as nature has not yet indicated the limit of the disease, has not separated the dead from the living bone, much good bone must of necessity be often removed with the diseased, or much of the diseased bone left behind; both of which

are undesirable objects. In one practice (the English) the cure is postponed and the difficulties of the operation are increased. In the other (the Continental) more may be done by operative interference than is needed or less than is required, the new formation of bone by the periosteum being, at the same time, necessarily interfered with.

The best practice, probably, is to be found between the two, and that is surgical interference about three to six months after the first appearance of symptoms; in acute disease, and in small and narrow bones, early interference; in chronic disease, and in large and thick bones, late.

The Operation.—There is no operation in surgery more satisfactory than this, for, as a rule, it is unattended with danger, and is followed by complete success; in many cases it is a simple one; in some it is complicated, and the ingenuity of the surgeon is often taxed to devise means to carry out the object in view,—the removal of the sequestrum. Taking the tibia when diseased as a type with the whole shaft or diaphysis the seat of the mischief, many cloacæ, or fistulæ, leading down to the dead bone through the periosteal bony case, will probably be present, as shown in Fig. 379; and with a probe introduced through an opening at one end and a second at the other, the surgeon may make his incision between the two down to the bone—that is, down to the new case of bone that envelops the old—and having done this he may peel back, with a raspatory or periosteal retractor, the periosteum, cut through by means of forceps or chisel the new bone that prevents the dead from being seized, and thus expose the necrosed shaft. This dead piece may then be seized by a pair of sequestrum forceps, and, where practicable, withdrawn. Should it be

FIG. 386.



Instruments used in sequestrotomy.

too long to extract through the wound, or should the opening in the bony case correspond to its centre, the sequestrum may be divided with a pair of cutting forceps, and its two halves removed separately. At times a good elevator is of use to raise the sequestrum from its bed, or to prise it from its attachment. At times a good deal of the new casing of bone re-

quires removal to enable the surgeon to get at the dead portion; thus, in the femur, where the whole shaft is necrosed, the upper part being larger than the lower, it may be necessary to chisel off or remove nearly the whole surface of the new shell of bone that surrounds the sequestrum to admit of its removal, it being impossible to withdraw through the lower orifice a piece of bone of larger diameter. In one case the simple enlargement of one of the cloacæ is sufficient to enable the surgeon to seize and remove the bone; in another it is necessary to lay two or more cloacæ into one. The object the surgeon has in view is to remove the sequestrum, and this should be done with as little interference with the soft parts and bony sheath as possible. The object having been obtained, the parts have only to be kept clean, raised, and left alone to fill up and heal, a good recovery being the rule. The instruments employed for sequestrotomy are illustrated in Fig. 386.

When the whole shaft of a bone has been removed in early life, some shortening of the new bone or arrest of growth may be looked for; in the case here illustrated (Fig. 387) such a result took place, the drawing having been taken from a young woman, æt. 25, from whom I removed, fourteen years before, the whole shaft of the tibia. The bowing of the limb is due to the bending of the fibula, which has grown naturally and bent to adapt itself to the shortened tibia.

FIG. 387.

When the sequestrum cannot be raised from its bed it had better be left alone, the opening the surgeon has made being not lost, for through it the sequestrum may subsequently be taken away or expelled naturally.

Dead bone, the result of periosteal disease, that is not covered in by new bone, readily exfoliates; it rarely requires more than its simple removal by forceps, the soft parts covering it being divided; in this way large portions of the skull may be removed. I have, in a child, removed nearly half the frontal bone, and in an adult, after syphilitic periostitis, large portions of all the cranial bones forming the vault. In one case large portions of the parietal, occipital, and frontal bones were taken away.

When necrosis of the bone takes place, and the sequestrum presses upon an artery, fatal hemorrhage may ensue. Thus, Poland has recorded in the "Guy's Hosp. Rep." three cases where such a result took place in necrosis of the femur, the popliteal artery in each having been wounded. Holmes has also recorded a case where a fatal hemorrhage from the lingual artery followed disease of the jaw, and from the aorta in caries of the spine; and a preparation in the Guy's Museum, (1243³⁰) shows a piece of necrosed tibia that perforated the anterior tibial artery and set up hemorrhage, which necessitated the application of a ligature to the femoral artery.

When necrosis occurs in a joint profuse suppuration and disorganization of that joint must ensue. Where this does not prove fatal, and repair goes on, recovery may be prevented by the presence of diseased bone; and when this fact can be established the removal of the bone is the best practice. In three cases I have done this in the knee with a good result, having in all removed large pieces of dead bone through a sufficient incision.

Such cases as these must be looked upon as cases of necrosis, the joint having lost its special features by previous disease.

Necrosis of the carpal and tarsal bones is a common affection. The bones die like the flat bones, no new sheath of bone preventing their exfoli-



ation or removal. They may be treated freely, such incisions being made as will allow of their removal. The os calcis is the bone most commonly affected. I have removed a large portion of this bone on several occasions with complete success. The epiphysis of the heel is not rarely affected. The scaphoid is sometimes involved, even at a very early period. The cuneiform and cuboid, separately or together, are also found diseased. Not long ago I removed from a boy's foot by two incisions the whole row of these bones, and an excellent foot was left—so good, indeed, that it was difficult to believe that so much bone had been taken away (Fig. 361). The same may be said of the carpal bones. Indeed, in these cases true conservative surgery is of great value. The removal of dead bone, however extensive, is a very safe operation, and is followed by results which are often startling by their success. There is no limit to the removal of necrosed bone, wherever found, and no limit to the amount of natural repair.

To amputate a limb, foot or hand, for necrosed bone until the surgeon has proved that the removal of the diseased part is impossible, or the operation has turned out unsuccessful, is scarcely a justifiable proceeding; for when dead bone is removed—and this dead bone may be looked upon as a foreign body—repair goes on uninterruptedly in even almost hopeless cases.

To gouge away bone that is inflamed and not dead, or to excise inflamed bones that may undergo repair, is a proceeding which is practically bad and scientifically unreasonable; for all bone that is not dead is reparable, and to interfere with it mechanically is bad surgery.

The great success of this operation for necrosis (sequestrotomy) is unquestionably due to the introduction of anæsthetics; before their introduction the operation was a difficult and dangerous one; indeed, it was rarely performed; amputation was too often its substitute.

Caries.—No word in surgery has been used with greater carelessness and with a greater variety of meanings than caries, and not one that conveys now a less definite idea. In the present page it will be applied to an unhealthy inflammation of bone—chiefly of cancellous bone. When superficial it is often associated with ulcerative or molecular necrosis, when deeply placed or central with necrosis or suppuration; it may or may not be associated with syphilis or struma. It is pathologically remediable and reparable, and whenever found is mixed up with reparative processes. In patients of feeble power and some constitutional cachexia, it may clinically be incurable, and thus require removal; and in very extensive examples the same observations may be applied. Nevertheless, in its nature it is inflammatory, and should be looked upon as a curable affection, depending more upon constitutional than local causes; in this point it differs from necrosis.

A bone is said to be *carious on its surface* when it is exposed and suppurating, throwing off a serous, purulent, more or less offensive discharge, containing excess of phosphate of lime, and mixed with small fragments of bone tissue; the bone then presents an irregular and worm-eaten appearance. It is generally associated with an ulcer or open sore of the skin over the parts, and more or less thickening of the periosteum and bone around and beneath the diseased portion. It is always vascular and bleeding on being touched. It is occasionally painful. At times it is soft and yields to the pressure of a probe; in other cases it is hard. When it attacks the articular surface of a bone it often forms pits with sharp well-defined edges, and under these circumstances has been looked upon as scrofulous, but with what amount of truth it is difficult to say. When it is associated with syphilis it follows the suppuration of a node. At times it is complicated with the tubercular thickening of the surface of the bone itself, or with what Paget has described as annular ulcers, in which a spot of ulceration

is seen which goes on to form a circular trench round a worm-eaten surface. This trench increases in width and depth, and at last loosens a sequestrum, which separates and leaves a circular depression. In bones of the skull this ulcer may involve one or both tables. *This ulcer* may subsequently heal, leaving a permanent depression.

When the *interior* of a bone is *carious* it is vascular, although softened sometimes almost to rottenness, and easily breaking down; it discharges often a thin, sanguineous, semi-purulent, fetid discharge, containing fragments and elements of bone; abscesses often coexist in and about the bone; it is generally associated with some external opening through the bone and soft parts, rarely with any sheath of new bone; at times it is combined with necrosis. In the spine—its most typical seat—it is often unassociated with any external suppuration or discharge. The bone with the intervertebral substance softens down and undergoes extensive molecular death, the particles being apparently reabsorbed and carried away; loss of much bone and interstitial substance takes place, and complete recovery follows without any external discharge. Around the inflamed or carious bone the cancellous tissue is generally infiltrated with organizable inflammatory effusion, the character of this effusion depending much upon the character of the inflammation. In feeble and strumous subjects the fluid will be of a serous, oily, and non-plastic kind (“Black on Tuberculous Bone,” Edin, 1859), the cancellous bone becoming more cellular and light, or, in more healthy types, the effusion will be plastic and organizable, the bone becoming more compact; in one case no consolidation of the surrounding bone will be present; in the other condensation of the bone to a greater or less extent will always be found.

Under all circumstances the nature of the inflammatory action turns much upon the constitutional power of the patient; in strumous and feeble subjects the disease tends to spread and but little to repair, in more healthy subjects to a local action and to recovery.

In rare examples genuine tubercle may coexist with the inflammation.

TREATMENT.—Looking upon the affection as an inflammatory one, and consequently as curable, it is to be treated on somewhat similar principles to inflammation of other parts. When the general powers of the patient are feeble they are to be stimulated by tonic medicine and tonic regimen; local pain is to be soothed and torpid action to be stimulated, but all mechanical and surgical interference is to be avoided, except the removal of dead bone, when such exists. In superficial or periosteal caries or ulceration, when rest, elevation, soothing, or possibly, stimulating applications with tonics, fail to induce a healthy reparative action, local stimulants are sometimes of use, the application of the mineral acids, such as the nitric or sulphuric, strong or diluted, having often a beneficial action. Pollock speaks highly of the value of sulphuric acid, at first diluted with equal parts of water and subsequently pure, the acid destroying or dissolving the surface to which it is applied, and setting up a more healthy action in the parts beneath, and thus hastening recovery. Boinet advocates the use of iodine, at first diluted and then strong; others recommend phosphoric acid. Dr. Fitzpatrick applies the Vienna paste or potassa cum calce to the surface of the inflamed bone, as well as to its deeper parts after puncturing them. The actual or galvanic cautery has also been employed; in superficial caries it seems to be valuable. In deepseated or endosteal caries some surgeons speak highly of operative interference, either by the gouging out of the diseased tissue or excision of the inflamed or carious bone. I allude to this treatment, however, only to condemn it. I believe it to be both unnecessary and injurious. It is unnecessary, as in the majority of

cases recovery can be secured without it; it is injurious, as gouging, as a rule, adds to the irritation, and thus tends to spread the disease, the gouging often tending to excite more general inflammation in the bone or endosteum, to set up an osteo-myelitis, as it is the fashion to call it.

Excision of the diseased bone is not an operation that can be highly recommended; it may be done, without doubt, with success, and in the tarsus has been successfully performed, many an inflamed or carious os calcis having been successfully excised; but there is a strong question as to the necessity of the operation. When the bone dies, the necrosed bone may be, and should be, removed, but in all other conditions it is reparable under constitutional treatment and local applications. Gouging inflamed bone is an operation that has found little support in my hands, and excising carious bones, as a whole, less. Surgeons who interfere surgically with carious bones usually prefer excision to any partial operation. Superficial or periosteal caries may be regarded and treated as an indolent ulcer in other parts, the repair being more chronic in bone than in soft tissues, and deep-seated caries or inflammation of bone may be regarded much in the same light. When syphilis complicates the case, iodine in one of its forms in full doses, and as a local application, is of great use, combined with any tonic that may appear to be needed.

CHAPTER LXXVIII.

TUMORS OF BONE.

TUMORS of bone in their pathology vary but little from tumors of other parts; where they differ, it is from the peculiarity of the tissue in or around which they grow: tumors of bone, as of soft parts, partake of the nature of the tissue in which they are developed. Thus, a tumor that would be fibrous or fibro-plastic in a fibrous organ is mixed with bone when originating in or upon a bone, and a carcinomatous tumor of soft parts becomes a malignant osteoid cancer of a bone. In addition to these, there is a special tumor of bone, known as the myeloid, and the cartilaginous.

Excluding, therefore, enlargements of bone due to inflammation, there are bony outgrowths, or *exostoses*, *cartilaginous* and *myeloid* tumors, all being, as a rule, of an innocent nature. There are the *osteo-sarcomatous* tumors, or fibrous tumors of bone, including those that have a periosteal as well as osteal origin, the fibrous and osseous elements predominating in various degrees; and, lastly, there are the *malignant tumors of bone*, whether of the soft or the hard kind, osseous matter being mixed up largely with both, and the disease acquiring the name of osteoid cancer when the bony elements predominate. Such tumors at times grow from the periosteum, at others from the bone itself.

Exostoses may grow from almost every bone; from the cranial bones, inside and out, as well as from those of the trunk and extremities. Those of the cranium are usually very dense and of ivory-like hardness; indeed, they are often called ivory exostoses. They are sometimes so hard that they cannot be removed. They may have broad bases; at times they are pedunculated, and in singular examples they occur as loose growths. Mr. Hilton has recorded an interesting case ("Guy's Rep.," vol. i), in which such a bony tumor, of twenty-three years' standing, fell out of a large cavity in the superior maxillary bone (Prep., G. M., 1665*). The man, in

1865, thirty years after the operation, was well, although disfigured by the hole in which the tumor has rested (Figs. 388-9).

FIG. 388.



FIG. 389.



Tumor as discharged from cavity in Fig. 388, weight nearly 15 oz., circumference 11 by 9 inches. Mr. Hilton's case.

These bony growths are more common about the orbit and air-cells of the head than elsewhere. At times they attain a large size. Birkett has related ("Guy's Rep.," 1868) a case of Dr. V. Bruns, in which an ivory tumor, of seventy-four years' existence, weighing ten pounds, grew from the occipital bone of a man *æt.* 80.

Exostoses from the jaws, or rather alveoli, are often called "epulis" (*vide* page 256).

Exostoses on the extremities are not uncommon; they are apt to spring from the point of junction of the shaft with the epiphysis (Virchow considering this seat as the usual one), and at the attachment of muscles. They are mostly outgrowths of bone, capped with cartilage by which they grow (Fig. 390); exostoses, however, of long standing have an osseous shell. They have at times broad bases, but more often narrow peduncles. They are often curved or crested, assuming odd shapes. They may grow to a large size. In exceptional instances they may die or necrose without any known cause. As a result of accident, they may be broken from their attachment. I have seen this in an outgrowth from the femur of a girl, *æt.* 12, who received a kick from a donkey; and in a second case, a patient of Mr. Birkett's, with an exostosis of the tibia. At times they are multiple. In a girl, *æt.* 16, I found exostoses of different sizes in both tibiæ and both hands, one humerus, one radius, and ilium; and in two patients, 9 and 16 respectively, five bones were involved.

Some exostoses have a *periosteal* origin, the result of organized inflammatory products; they are usually diffused. Fig. 391 shows this well; it was taken from a patient of my father's, the late Mr. T. E. Bryant.

Ungual exostoses deserve a special notice, for they are even now too often mistaken for what is called an ingrowing toe-nail. Liston, in 1826, first drew attention to the nature of these cases; they are generally found on the distal phalanx of the great toe (Fig. 215, page 414). Prep. 1287,

FIG. 390.

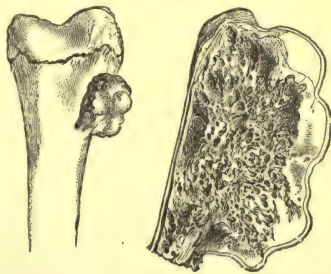


FIG. 391.



Periosteal exostosis. Prep. 1114^m, Guy's Hosp. Mus.

Guy's Museum, shows a specimen on the little toe; and I have had under care two cases in which one existed on the thumb.

The osteophytes and the outgrowths of osteo-arthritis are not classed amongst the exostoses.

TREATMENT.—Nothing but the removal of these growths can be entertained, their bases being well levelled down to the bone, or even scooped out. In cranial exostosis this operation may not only be difficult, but impossible; still, where the attempt can be made it should be, for many unsuccessful attempts have ended in procuring the death of the exostosis, and its subsequent exfoliation. In such a case, treated by Mr. Cock, where the removal of the whole was impossible from its hardness, what remained subsequently died.

Intracranial exostoses are rarely made out during life; they are at times associated with epilepsy.

The following analysis of 120 cases of exostoses will show the seat of these growths. 45 were tabulated by my colleague, Mr. Birkett, in "Guy's Reports;" the remainder are from my private notes. Cases of epulis are excluded.

Frontal bone, 3	Clavicle, 3	Tibia, 18
Upper jaw, 1	Humerus, 15	Fibula, 4
Lower jaw, 3	Ulna, 1	Patella, 1
Bodies of cervical vertebrae, 1	Radius, 2	Tarsal bone, 1
Sacrum, 1	Fingers, 5	Metatarsal, 1
Ribs, 3	Ungual phalanx of thumb, 2	Ungual phalanx of great toe, 25
Ilium, 1	Femur, 18	Sole of foot, 1
Scapula, 10		

It is worthy of notice that when the radius was affected it was in common with other bones, three of the cases tabulated being cases of multiple exostosis.

Enchondromatous or cartilaginous tumors of bone are most commonly met with in the phalanges and metacarpal bones. They are, however, seen surrounding bones and having a periosteal origin, or growing from the bones of the upper jaw; a remarkable instance of this has been recorded in Chapter XXIX, and figured in Fig. 140. It would appear that such cartilaginous tumors are more prone to attack the scapula than other bones; I have seen several such cases. Mr. Birkett has recorded and figured a fine specimen in the "Guy's Reports," 1866.

The bones of the pelvis are likewise at times the seat of such growths. I have the records of a remarkable instance in which the pelvic surface of the ilium was the seat of the affection, and am watching now in a middle-aged woman the increase of an enormous cartilaginous outgrowth the size of a coconut, evidently springing from the pelvis, and occupying the inner side of the right thigh beneath the adductor muscles.

The cartilaginous tumors of bone usually originate in the bone, and occur in young subjects when the bone is growing; they are covered by the shell of bone in which they originate, the cartilage expanding it, sometimes in all, but more usually in one direction. In Fig. 392 this mode of growth is seen; it was taken from a model in the Guy's Museum. In Fig. 229 the section of such a growth is well illustrated.

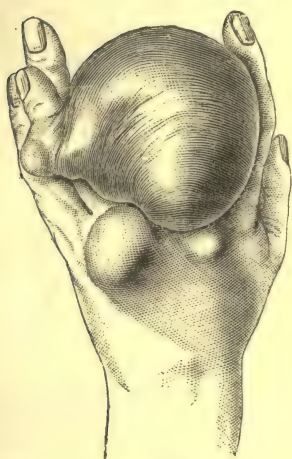
Cartilaginous tumors are usually of slow growth and painless, with a smooth outline; at times they undergo decay and soften down, discharging

a brown-colored serous fluid, unlike any other tumor. At other times they ossify and turn into bony tumors, the "bulbous exostosis" being often an ossified enchondroma.

TREATMENT.—Where they can be scooped out of a bone they should be; in the phalanges and metacarpal bone this practice is usually successful. Extreme examples of the disease demand amputation or excision of the affected bone.

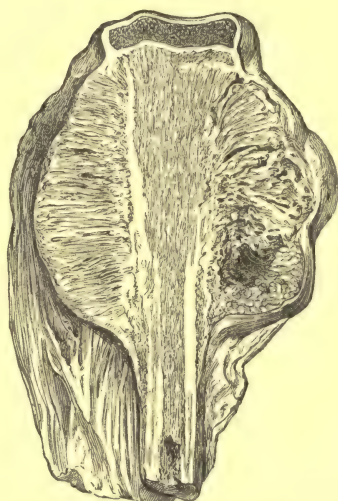
At times enchondromatous tumors are recurrent, and in rare examples return in other parts of the body as malignant tumors. Such growths are usually rapid in their increase and diffused, having a periosteal origin; true cartilaginous tumors of bone are usually circumscribed and often multiple, the bones of the hand at times being much involved.

FIG. 392.



From a model in Guy's Museum.

FIG. 393.



Periosteal osteo-sarcoma. Drawing 20, Guy's Hosp. Mus. Key's case.

Osteo-sarcoma is a term of broad signification; it is usually applied to the fibrous tumor of bone, fibre-tissue and bone-elements predominating in various degrees. Wilks believes "that they are altogether comparable to the fibrous tumors of soft parts." They usually have a periosteal origin—periosteal sarcoma—and even in exaggerated examples the shaft of the affected bone is to be clearly traced through the growth. The tumor is usually circumscribed, with a fibrous capsule, and divided by fibrous rays, or ossific rays, into different portions; at times the fibrous element predominates, as seen in Fig. 393, at others the osseous. The disease is usually seen attacking the ends of the shafts of bone, and not the epiphyses.

Cartilage is often found to be mixed up with the fibrous and osseous elements. In proportion to the amount of bone-matter entering into the formation of the tumor may it be regarded as innocent, bony periosteal growths being rarely cancerous. When fibrous tissue, and more particularly the softer forms of fibrous tissue, predominate, the tumor probably tends towards a recurrence in the same spot, or in some other organ, as with cancer.

Osteo-chondroma is applied to a tumor involving bone, made up of cartilage and bony elements in variable degrees, the cartilage taking the place of the fibre-tissue of the osteo-sarcomatous tumor. In one case bone will predominate, in another cartilage. The disease is usually of slow growth and simple in its nature. In the case from which Fig. 394 was taken the disease had existed for three years, in a woman, *æt.* 34. Fig. 395 was taken during life.

Myeloid tumors of bone may be regarded as innocent tumors, exceptional instances being on record in which a return in the part or internal organs took place. They usually attack also the articular ends of bones

FIG. 394.



Drawing 87a.

FIG. 395.



Photo. 87a.

FIG. 396.



Expansion of condyles of femur from myeloid tumor.

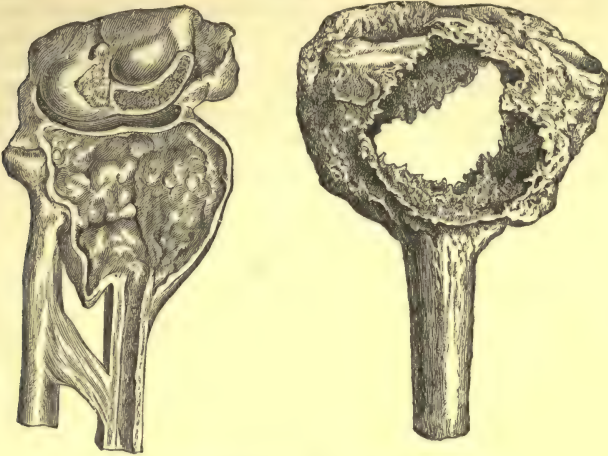
(Fig. 396), either the epiphyses or epiphysial ends of the shaft. I have seen the disease, however, involving the shaft of the radius, and Paget has described it as attacking the breast. It begins in the centre of the bone, and gradually expands it, forming a globular shell of bone, the *spina ventosa* of the older writers (Fig. 397), or the malignant. The interior of this shell is made up of fibre-tissue, or it may be cystic, the cavity being divided up by means of fibrous septa into more or less well-marked cystic divisions. The cells themselves, or loculi, contain the characteristic myeloid material, "an opaque white, intermixed with a semi-transparent gelatinous-looking substance of a *cherry-red color*," and their substance is made up of the characteristic polynucleated and irregular myeloid cells (Fig. 294).

When the tumor encroaches on the joint the cartilage is usually spread out over the tumor, but intact. These tumors were originally mixed up with the cancerous or fibro-plastic of Lebert. They are found also in the gums as "epulis," and in other parts.

Cancers of bone, as of other parts, show their malignancy in involving the utter destruction of the bone in which they are developed. They may originate in the periosteum or bone, but in either case both tissues will be affected; when they originate from the periosteum the bone may be found in parts running through the mass, the cancerous elements surrounding the shaft, but when the disease has existed for any period the same cancerous elements will be found in the shaft itself and destroying it. When the

disease begins in the bone it is usually in the medulla, one or more different centres of disease coexisting; these by their increase expand the bone

FIG. 397.



Myeloid tumors. Guy's Hosp. Mus.

and destroy it utterly. The bones under these circumstances are very brittle and are apt to break on the slightest force, or even ordinary muscular action, a fracture occurring in a cancerous bone without any external evidence of its presence. I have known such a fracture to take place by a patient turning in bed. In the majority of cases of cancer of the bone, bone elements have little to do with it, but in what is called the true osteoid cancer masses of bone of a condensed kind appear in the medulla and gradually grow until a large osseous mass of disease is formed.

In Fig. 398 this is well seen. It was taken from a patient of Mr. Key's, æt. 56, masses of bone and cartilaginous tubercles being found after death in the lungs, pleura, and lymphatic glands.

The periosteal form of cancer grows more rapidly than the endosteal or interstitial, and is not often accompanied by pain; it rapidly assumes a large size, and is rarely globular in its outlines, the swelling both above and below gradually losing itself in the surrounding parts. Large full veins will likewise be seen in the integument covering it in, from obstruction to the deep veins. It will possess a semi-

elastic feel, and often have to the touch an unequal feel as to density. Endosteal cancer is commonly attended with pains, of a dull aching kind, due to the expansion of the bone. Its increase is at first slow, but when it has so destroyed the bone as to have reached the periosteum, pain will have lessened, but the increase of the tumor will be more rapid. This form of cancer is more frequently secondary than primary.

FIG. 398.

Osteoid cancer of knee-joint. Prep. Guy's Hosp. Mus., 1165⁴⁰.

Primary cancer of bone or periosteum is more common in children than in adults.

The diagnosis of any tumor of bone is often difficult, and in most cases only an approximation to truth can be made.

A globular tumor involving the articular end of a bone, where the bone is clearly expanded and the joint sound, of slow, steady, and probably painless growth, in a young subject or adult, is probably myeloid. A more elongated or ovoid tumor, involving the shaft of a bone, of more rapid growth, with full veins in the soft parts covering it, and a semi-elastic, unequal feel, in a young subject, is probably a periosteal cancer. A firm, fibrous growth, of a somewhat globular form, of gradual increase and unequal surface, fibrous in one spot, bony in others, in an adult, is probably an osteo-sarcoma. A more indurated growth, with a botryoidal outline, and a similar clinical history, is probably an osteo-chondroma.

Pain, rapid growth, diffused growth, with unequal density, glandular enlargement, venous obstruction, and wasting, generally indicate cancer.

Gradual, painless increase, a defined contour, globular, botryoidal, or in ridges, with no venous obstruction, glandular enlargement, or disturbance of the general health, usually indicate a benign growth. The more globular the outline the greater the probability of the growth being myeloid. The older the patient and the more botryoidal the growth the greater the chance of its being enchondromatous. The slower the growth, the more local and divided into septa, the chance of its being osteo-sarcoma is increased.

When a tumor is periosteal, on making firm pressure below the tumor the bone will be made out to be on a lower level than the growth. When the tumor is endosteal, and the bone is expanded, on making firm pressure below the surface of the bone, the bone will be felt to rise gradually from the unaffected part over the surface of the growth, to form its shell.

TREATMENT.—A tumor of bone can only be effectually treated by its excision, and when it involves the articular end of the bone and encroaches upon a joint amputation is too often a necessity. When the whole bone is involved, as in a cancer, nothing but amputation can be entertained, and it is usually well to steer clear of the disease; when it is placed in the head of the tibia, an amputation at the knee-joint may be performed, or, where this is inexpedient, just above the condyles. When the condyles of the femur are the seat of the disease the amputation should be at the centre of the shaft, it being only justifiable to amputate at the hip-joint when the disease is too extensive to allow of an amputation through the bone, for the hip-joint operation is most fatal, and should only be performed when any less severe measure is impossible.

In an evident cancer of the lower half of the femur, however, where amputation is to be performed, it had better be at the hip-joint. In doubtful cases the limb may be removed just above the growth.

In the upper extremity, however, where amputation at any of the joints is a sound and successful operation, it is wise in cancerous disease to remove the whole of the affected bone, and to amputate at the articulation above. Amputations for myeloid and simple tumors are generally successful; a young woman for whom I amputated the thigh for myeloid disease twelve years ago is still well.

In tumors involving the shafts of bones, or even the articular ends, and not the epiphyses, when the growth appears to be local and probably simple, the surgeon should at first attempt to deal with it locally, and scoop or turn it out of the bone, rather than excise it or amputate the limb, the more severe measure being alone had recourse to should the minor one fail. In the enchondromatous tumors of bone and fibrous tumors this

measure is usually successful. In fact, in the treatment of tumors of bone, when the disease can be removed without making any great sacrifice of other parts, the attempt should be made. Amputation, as a primary measure, is to be reserved for clearly cancerous cases or diffused growth, or for such as involve the articular ends of the bones, and, consequently, the joint.

Pulsatile tumors of bone are, as a rule, cancerous; they may, however, be only aneurismal. Cancerous tumors of the skull are frequently pulsatile, and in one well-marked case I had under care, some time ago, in which the frontal bone was the seat of the disease, this pulsatile condition was its early symptom, the swelling being comparatively unnoticed. All pulsatile bone tumors have an interstitial origin, and expand the bone, the new growth receiving its impulse from the large arteries that supply it. Gray ("Med.-Chir. Trans.," vol. xxxix) has recorded an example of pulsating myeloid. True cases of *osteo-aneurism* are rare. Mr. Bickersteth, of Liverpool, has recorded such a case, and I had the pleasure of examining it carefully with Mr. W. Adams, and reporting upon it to the Pathological Society, vol. xix. It was, undoubtedly, a genuine case of this disease involving the tibia. Mr. Mapother ("Dublin Med. Trans.," 1863) has recorded another. Such cases are made up of expanded bone from aneurismal dilatation of the vessels of the bone.

TREATMENT.—Pulsatile cancerous tumors of bone are to be treated as the non-pulsatile, by amputation; true osteo-aneurisms, when they can be made out and are of a limited size, by local extirpation or destruction by means of the cautery, actual or galvanic, in more extensive examples by amputation. Dr. Mapother cured his by the actual cautery, Mr. Bickersteth by amputation.

Cysts in bone are occasionally met with, serous, sanguineous, and hydatid. The two former are the most commonly met with in the jaws, and in Chapter XXIX attention has been drawn to them. Whether they ever occur in the long bones is an open question. In 1870 I trephined the shaft of the tibia of a man, æt. 30, who had had gradually progressive disease in it for about fifteen years; the bone was the seat of a fixed pain in its centre, and enormously enlarged from expansion. I trephined it, looking upon the case as one of abscess, and having perforated a dense shell of bone, an inch thick, I came into a cavity the size of an egg, which contained *no* pus, and what escaped from it was not to be distinguished from the blood that flowed during the operation; the operation was quite successful, and a rapid cure ensued; the cavity was lined with the soft velvety material usually met with in abscess. I believe this case to be one of cyst in the bone, no pus being found.

Hydatids are found in bone. In the Guy's Museum there is the head of a tibia containing a cyst or echinococcus, which holds many smaller ones within it; another specimen illustrates the existence of hydatids in the spinal bones. In 1869 I saw with Dr. Freund, of the City, a case in which a large hydatid escaped from the condyle of the humerus after a puncture in front of the joint; the humerus was very much expanded, and the hydatid had clearly made its way into the elbow-joint, and through this externally. A good recovery with a stiff joint ensued.

Epithelial cancer may attack a bone simply by the extension of the disease from the soft parts. In cancer of the lips this result is not rarely seen; skin cancer may also extend downwards into a bone, and cause great destruction. At times a bone that has been the seat of necrosis may become the seat of cancer; within the last few months I have had three such cases under care; in two the tibia was the seat of the disease, necrosis having in

both existed for upwards of twenty years. Fig. 399 was taken from the limb of one after its amputation at the knee-joint. In the third example, although the femur apparently became necrosed first twenty-two years

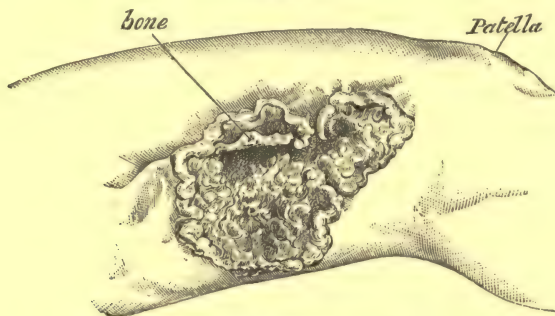
FIG. 399.



Cancer of tibia.

before the man came under my care, the cancer evidently began in the skin over it, and extended down the sinuses into the bone; Fig. 400 was taken

FIG. 400.



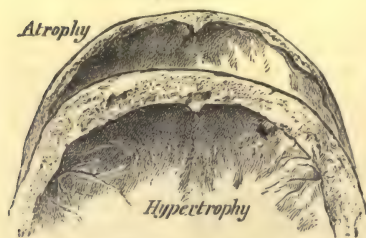
From Edward Abrahams, et. 42.

from the limb during life. In another case I had years ago the os calcis and the soft parts over it were the seat of the disease, the os calcis being found after amputation infiltrated with cancerous epithelial elements.

Hypertrophy and atrophy of bone are pathological realities, although during life it may be a difficult, if not an impossible, task to recognize such conditions: thus hypertrophies and chronic inflammatory changes are often mistaken the one for the other, although in the former the enlargement is gradual and painless; in the latter it is associated with local pain and other evidence of inflammation. In some cases the bone is enlarged, and its cancellous structure expanded (porous hyperostosis); in another it

is enlarged, but at the same time more dense (sclerotic hyperostosis). These changes are best seen in the calvaria (Fig. 401); in Prep. 1068³⁵ in Guy's Museum the bone is at least double its normal thickness. In rare cases the hypertrophy is clearly due to increase of function, as in another preparation in Guy's Museum, 1000^{1a}, where the bones of the upper extremity are larger than those of the lower; the man was a paralytic, and had used his arms for progression. In the majority

FIG. 401.



From Prep. in Guy's Museum.

of cases, however, the hypertrophy is inflammatory, and even in the case

which Mr. P. Hewett mentioned, in his well-known "College Lectures," where the man's skull increased so imperceptibly year by year as to be only recognized by the gradual increase in the size of his hat, the disease was traced to an injury. Mr. Durham believes the porous hyperostosis to be the transition of bones softened by mollities.

This affection is interesting pathologically, although surgically nothing can be done for it.

Atrophy is most commonly the consequence of disease in the shafts of bones that have not been used for many years, whether in paralytic subjects or in others who have been the subjects of joint disease. In the bones of the aged, and in those that have been injured, the bone may become a mere shell, its cancellous tissue being expanded, and the cells filled with fatty matter.

When atrophy follows injury Curling's suggestion ("Med.-Chir. Trans.," vol. xx) that the causes may be found in injury to the medullary artery is probably right, although it cannot be the only explanation, Norris having recorded ("American Journ. of Med. Sci.," 1842) a remarkable case, in which, after a double fracture of the humerus about its centre, the whole bone disappeared, the forearm subsequently swinging as a thong, and the arm being shortened six inches: the bone disappeared "by the gradual action of the absorbents."

In these cases spontaneous fracture is very prone to occur, or fracture from slight muscular action.

These cases must not be confused with the elongations of the shaft of a bone which are due to inflammation, or to the shortening of a bone from arrest of its growth following disease or the removal of the shaft, or some injury to the epiphysal cartilage that connects the shaft with the epiphysis; for it cannot be too strongly impressed upon the student's mind that any disease or injury that in any way interferes with the nutrition of the epiphysal cartilage, through which the long bones mainly grow, will be followed by arrest of the bone's growth, and consequently by the shortening of the limb; that is, when the disease or accident occurs in early life during the period of growth.

I have before me the notes of several cases in which this result ensued. In one, the tibia was one inch shorter than its fellow in adult life, following the removal of a necrosed shaft in early life (*vide* Fig. 387); in another, nearly the same amount of shortening followed an injury to the superior epiphysal line of the tibia; and in a third, the same result ensued after a displacement of the lower epiphysis. In all these cases the fibula was curved outwards, having grown as the other bones, the outer malleolus being much lower than the inner, and the shaft of the bone bent. In one case the head of the fibula was partially displaced outwards.

Mollities ossium, or osteo-malacia, is a rare affection, and its cause is wrapped in obscurity; it is usually discovered during, even if it does not originate from, pregnancy, and it is chiefly found in subjects who, from some cause or other, have been subjected to prolonged depressing influences, more particularly upon the nervous system.

My colleague, Mr. Durham, in an able paper upon the subject ("Guy's Rep.," 1864), believes "that mollities ossium is to be regarded as a particular expression, as it were, of a general morbid condition of the system, rather than as a special disease of the bones themselves," and I think there can be little doubt as to the soundness of the opinion.

The first symptom of the disease, writes Durham, is pain, more or less peculiar in character, always deepseated, and greatly increased by pressure or motion, sometimes coming on suddenly and with extreme severity,

sometimes commencing vaguely and insidiously, and gradually becoming almost insupportable, sometimes wandering, at other times fixed for a period to some particular spot, and subsequently spreading to other parts; sometimes intermitting, at other times unceasing. In the majority of cases the pain appears to have been first felt in the lower half of the spine, the pelvis, and loins; but in some it commenced in the feet, knees, or other parts of the lower extremities; the pains are often looked upon as rheumatic. Associated with the pain there has always been noticed, on the part of the patient, at a very early period of the malady, a feeling of general lassitude and disinclination to do anything. This feeling has increased more or less uniformly until it has ended in actual inability to make any exertion whatever, and with the early local changes are associated an uncertain, feeble gait, and continual fear of falling.

Symptoms that are more or less directly associated with the softening and absorption of the bones are the next to appear, such as diminution of stature, deformity of the spine or pelvis, some curvature or fracture of one or other of the long bones, and, as time progresses, these indications multiply, *flexibility*, conjoined with fragility, being the distinguishing character of the bones in this disease.

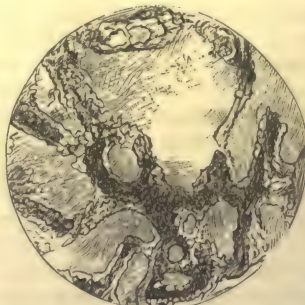
The urine almost always contains a considerable excess of lime salts. The disease is rarely attended with any general or local symptoms of inflammation. The changes observed in the bones are carefully described by Durham. Increased vascularity appears to be an early symptom, the large grooves seen in the cranial bones being very striking; next, the bony matter is seen to be more opaque and less uniform than natural; sometimes it is irregularly granular, "as if some disunion must have taken place between the component elements of the bony matter."

The lamination of the bones next becomes less distinct; the laminae of the Haversian system appear more or less fused together; the bone-corpuscles become wider, although not with certainty more numerous. At a later date the earthy matter becomes absorbed; the Haversian canals become surrounded by a transparent ring of animal matter; these rings then become disintegrated and absorbed. By this process the Haversian system become destroyed, the bone assuming a hollowed-out, porous, or somewhat sponge-like appearance, the contrast between the healthy and diseased bone being well seen in Figs. 402-3.

FIG. 402.

Section affected with mollities.
Durham, "Guy's Rep.," 1864.

FIG. 403.



Section of normal occipital bone.

The same changes occur in the cancellated as in the compact tissue. In the more advanced stage the bone disintegrates rapidly; débris of tissue

fills up the large spaces, such as the remains of bloodvessels, shreds of membrane, fat- and oil-globules, with "marrow-cells."

Chemically the inorganic constituents are greatly diminished, and chemical disunion and physical disunion coexist, the earthy matter being more readily dissolved out of the diseased than out of normal bone. In healthy bone, writes Durham, the constituents are combined; in diseased bone they seem rather to be mixed. The animal constituents are likewise more fatty and less nitrogenized than in normal bone, the fat is more free. In the mineral constituents the proportion of the carbonate of lime to the phosphate is much diminished.

The *prognosis* in these cases is always bad, although the possibility of a cure is not to be doubted. Trousseau relates cases in which a good result was obtained under the combined influence of rest, warmth, good food, and cod-liver oil, the deformity, of course, remaining. Lime salts are not to be given in these cases; they cannot be retained, and to give them, adds Durham, is only to throw additional work upon the excreting organs.

Rickets is an affection of early childhood, and by Sir W. Jenner is said to be the commonest of the diathetic affections among the London poor; it is, however, found in the families of the higher classes. It is essentially due to some malnutrition of the body, probably connected with mal-feeding and the use of farinaceous food in lieu of animal, the bones during their period of growth expanding at their epiphysial ends and bending in their shafts, and being very prone to incomplete or green-stick fracture. "Displacement and obliquity of the epiphyses may ensue from softness and flexibility of the layer of bone uniting it to the diaphysis, as is seen more especially in the ribs; but a slighter degree of epiphysial obliquity is noticed in many of the joints of the long bones, such as the knee or ankle; the weight of the body is thus thrown unequally, so that one set of ligaments has to bear more traction than another. These ligaments then yield, and the joint becomes loose, so that rachitic knock-knee (*genu valgum*) or bow legs (*genu varum*) is formed."

"From sustaining the weight of the body the femur bends forwards, the tibia usually forwards and either inwards or outwards, the greatest amount of yielding being where the bone is thinnest and weakest. In many cases we find the os femoris bent forwards, with anterior and outward curvature of the tibia, knock-knee and flat-foot being coexistent in the same individual. Just so far as the rachitic condition extends, so may we look for abnormalities of form; thus, the *pelvis* may acquire some of those well-known contractions of its outlet which are matters of such grievous moment to women at the period of parturition," the pelvis either retaining in adult life the small size and imperfect development of infancy, or becoming narrowed as to its cavity in one or other of its diameters.

The chest likewise undergoes allied changes, and Mr. Shaw has well pointed out ("Holmes's System," vol. iv) how "pigeon breast" is one of the effects of the disease; atmospheric pressure bends in the bones that have lost their elasticity and become softened, causing a projection of the sternum and lateral flattening of the chest.

In the spine a general curving of the whole column is the more usual deformity; "*lordosis*," or anterior projection of the lumbar vertebræ, as a compensating curve, is found when pelvic obliquity is present.

In all cases of rickets Humphrey has shown ("Med.-Chir. Trans." 1862) that deficiency of growth coexists with deformity, the lower limbs indicating this more than the upper and in their proximal segment. In severe cases all the bones are more or less deformed, the *cranium*—often large—presenting a quadrilateral aspect, the sutures being wide open till a late

period of life or even subsequently reopening, the bone remaining thin or subsequently thickening. The periosteum in these cases is usually thickened both in the flat as well as the long bones.

The general symptoms of rickets are those of debility, muscular and general weakness of the whole frame, gradually passing into that of rickets; dentition is retarded, and teeth decay or drop out. Sir W. Jenner lays great stress upon profuse perspiration of the head during the night, a tendency to kick off the bed-clothes, and general tenderness of surface, as constant symptoms of the early stage.

Tomes and De Morgan tell us that a rickety bone has the structural arrangement of normal bone without the earthy salts. Jenner ("Med. Times," 1860), however, describes an enlargement of the lacunæ generally, the effusion of a red pulpy substance in the cancellous tissue, and a thickening of the periosteum; and Gee ("St. Bart. Rep.," 1868), Dickinson ("Med.-Chir. Trans.," 1852), and others, have pointed out how the viscera undergo some "albuminoid" changes, unlike the waxy or lardaceous disease.

Rickets is a curable affection, that is, if taken before it has advanced far, and it is remarkable to what an extent the deformities are remediable under natural processes, the curved or bent shafts of bone recovering their natural shape on taking off downward pressure and improving the general powers of the child. In more severe cases, where the curvature cannot be remedied, the bone consolidates and becomes strengthened by buttresses of bone along the concavity, and, although the stature may be diminished and the limbs deformed, the general powers of the patient may be restored and a sound recovery take place.

TREATMENT.—The *medical* treatment of rickets is to be conducted on reasonable principles—fresh air, and abundance of it, simple nutritious food, such as may suit the condition of the digestive organs, being essentials; milk and beef tea for young children should be mostly relied upon, meat in moderation for the older. Cod-liver oil, iron, and quinine, are also very valuable drugs. The bowels should be carefully looked to, all violent purgatives being avoided.

The *surgical* treatment, in the early stages, is to prevent deformity, and in the later to remedy it. By way of prevention the child should be restrained from any prolonged standing or sitting position, the horizontal posture should be observed as far as possible, some little exercise being allowed and then rest, the two alternating according to the powers and necessities of the case. As the general health and powers improve, more liberty may be allowed. In spinal cases these observations are more especially binding. Movable couches and spinal chairs in these cases are of great value.

Where moderate deformity exists, more particularly in the lower extremities, it is interesting often to observe how, by these means, the bones recover their normal shape, children "growing out" of their deformity as their health improves, as long as the surgeon takes care it is not increased by neglect.

In still worse examples, and where exercise is essential and intermittent rest will not be observed, splints and instruments may be bound to the legs. Two long side splints reaching to the ground, carefully bound together, are as good as any, and removed at night, or an iron splint with joints at the knee and ankle. Some surgeons prefer an outer splint for knock-knee, and an inner one for bow legs.

When the curvature of the shafts of the leg bones is very great or very acute, Mr. H. Marsh has adopted the plan of forcibly straightening the bones with the patients under chloroform. He thinks little of the risk of

breaking the bone, knowing how rickety bones unite ("St. Barth. Rep. for 1870"). He thinks the plan more adapted for acute than chronic cases. In extreme cases a wedge of bone may be removed from the shaft. I did this once some years ago in a child about six years of age, with advantage, and Mr. Little has also had a successful case. It is only to be done in extreme instances of deformity, when no hope of improvement by other means can be entertained.

CHAPTER LXXIX.

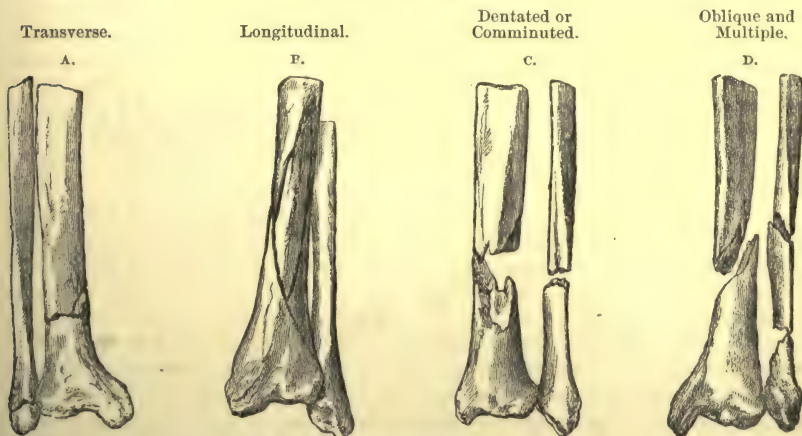
ON FRACTURES.

WHEN a bone is broken it is said to be fractured; when the skin and soft parts covering in the broken bone are whole the fracture is *simple* or *subcutaneous*; when a wound exists *communicating with the broken bone* the fracture is *compound*, whether the wound be caused directly by the same force that produced the fracture or indirectly by the bone perforating the skin. A simple or compound fracture is said to be *complete* when the solution of continuity is complete; *incomplete*, when the bone is only *cracked*, *fissured*, or *bent*, as in "*green-stick*" fracture, where the bone is splintered on its convex surface and not on its concave; *splintered*, when a portion only of the bone is cut off, either by a sabre wound, in machinery, or by some local injury chipping off the edge of a bone; *impacted*, when one end of the broken bone is driven into and fixed in the other. A bone may also be *perforated* by a gunshot or punctured wound.

A *complete fracture* may be transverse, oblique, longitudinal, dentate, or comminuted, multiple of the same bone, of contiguous bones, or of sepa-

FIG. 404.

COMPLETE FRACTURES.



Prep. Guy's Hosp. Mus.

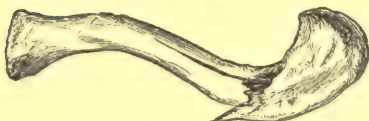
rate and distant bones (*vide* Fig. 404). All fractures may likewise be complicated with other injuries, those into joints being the most important.

Fractures and separation of epiphyses are also intimately connected;

fractures may, however, occur at any age, but separation of the epiphyses is only found in subjects under twenty-one.

A fracture may be met with at every period of life; indeed, it may occur *in utero* from some external violence, and when the accident has taken place some time antecedent to birth repair may have gone on to completion, although generally with deformity, the *vis medicatrix nature* being, as Billroth well observes, a better physician than surgeon. I have seen an infant with a humerus bent at right angles, evidently from a repaired intra-uterine fracture. The fractures of infancy are comparatively rare, and are commonly incomplete or green-stick. Fig. 405 illustrates this in the clavicle, and Fig. 406 in the parietal bone. The latter was taken from a child

FIG. 405.



From Holmes's System.

FIG. 407.



FIG. 403.



Incomplete fracture of the parietal bone of infant.

æ. eight months, who was thrown out of its perambulator on to the pavement. No symptoms of brain disturbance followed the accident at any time; the bone gradually became pressed out. The drawing was taken on the second day following the accident. The case occurred in the practice of Mr. Harris, of South Hackney.

Fractures in the adult are mostly complete; an incomplete fracture may, however, occur. Impacted fractures (Fig. 407) are chiefly found in the aged, the bones being at this period more brittle. The hip and wrist are the most frequent seats, but they occur also in the humerus.

Men are more liable to suffer from fractures than women, on account of their more constant exposure to injury, and those bones suffer the most that are the most exposed to external violence, the lower extremity being particularly liable.

Diseased bones are always predisposed to fracture from slight causes, more particularly rickety and cancerous bones, bones that have atrophied from any cause, or that are the subject of *fragilitas* and *mollities ossium*, and bones, also, that are weakened by the presence of tumors or some syphilitic or other inflammatory affection.

In diseased or brittle bones muscular action may be enough to cause fracture; thus, I have known a thigh to be fractured in turning in bed, in an epileptic attack, and in swinging it over the side of a cart; the humerus, in the act of hugging a wife, and in a man, æ. 26, from throwing a stone; the clavicle, from lifting a heavy weight; the ribs, in coughing, the radius,

from wringing clothes; and every surgeon knows how frequently the patella is broken from muscular spasm, and more rarely the olecranon.

"From a review of the observations made on the bones of two insane patients," writes Dr. Ormerod ("St. Bart. Hosp. Rep.," 1870), "it may fairly be inferred that the brittleness of the ribs depended on a morbid condition of the bones, and that this condition was general, affecting different parts of the osseous system coincidently, though more marked in the ribs than in some other more compact bones. The process was essentially one of absorption of the internal structure of the bone, the osseous tissue being replaced by an excessive deposit of the fatty matter normally existing in its interior. Thus, the usually invisible membrane lining the Haversian canals, and forming the coats of the vessels lying there, was thickened into a membrane of cognizable structure and dimensions. The space for this thickening was obtained by removal of the innermost concentric laminæ; and from this point a change was propagated which resulted in or tended to the removal of each entire Haversian system. In the whole bone there was a loosening of the mutual connection of the laminæ and an obscure disintegration of the osseous structure itself, and a general infiltration of oily matter into the substance, which had intruded itself within the Haversian canals, and into whatever part of the compact structure of a bone could find room for it."

In confirmation of these views I may mention that for some years I have been attending with Dr. Black, of Canonbury, a middle-aged lady who is the subject of dementia and epilepsy. During each of the last nine or ten fits, none of them having been violent, she has broken a bone; on several occasions she has broken two. I must add that the fractures have taken place when the patient was in bed, by mere muscular action. They have all, however, repaired well—indeed, as well as if the subject of them had been quite healthy.

The *immediate cause of fracture* is usually some *direct violence* applied to the part, or *indirect*, the bone giving at its weakest point under some bending force.

Indirect fractures are, as a rule, of the simplest kind, unless complicated with joint dislocation; when compound the soft parts are mostly injured by the protrusion of the fractured bone.

Fractures the result of *direct violence* are always the most severe; the same violence that breaks the bone injuring the soft parts over it, and often comminuting the bone.

The mode of production of a fracture is consequently a point of great practical importance, both for diagnosis, prognosis, and treatment.

The *diagnosis* of a fracture is usually easy; in exceptional cases it is very difficult, if not impossible.

It is easy when, after a blow or fall attended by the sensation of something giving way, *deformity* is found, with *inability to move the limb*; when on manipulation *abnormal mobility* of the injured limb exists, and *crepitus* from the rubbing of the broken fragments together; when *pain* attends any attempt at movement, and *swelling* rapidly follows the accident; when *shortening* exists, and this is remedied by extension.

The diagnosis is difficult when, as in *impacted fractures*, abnormal mobility and crepitus are absent; slight but fixed deformity, local pain, and shortening, are the only symptoms, and the nature of the accident the only guide; when a transverse fracture of such a bone as the tibia exists without displacement, and no fracture of the fibula; when the fracture is into or in the neighborhood of a joint, and much swelling of the parts exists; when a fracture and dislocation coexist.

It is sometimes difficult to diagnose a fracture from a separated epiphysis. A simple fissure of a bone, cranial or otherwise, is always difficult, and at times impossible to make out, and the same may be said of a fracture of the pelvis or thorax; such injuries as these are to be made out only by the natural symptoms of fracture, as they are called, by such as are referred to the contents of the cranial, thoracic, or pelvic cavities.

When a fracture is *transverse* (Fig. 404, A), there may be no displacement, or only some slight lateral; when *oblique* (Fig. 404, D), there will probably be some shortening of the limb from the drawing up of the lower portion of the limb, or *riding*, as it is called, the lower end riding over the upper, or *vice versâ*. At times there will be rotation of the limb, and in comminuted fractures direct separation. (Fig. 404, C.) These points will be greatly determined by the character of fracture, the bone that is involved, and the amount of muscular action that influences the fracture.

In parallel and conjoined bones, of which only one is broken, the deformity that exists is likely to be less marked than where an isolated single bone is broken; for under these circumstances the non-fractured bone tends to neutralize the action of the muscles through which deformity or contraction usually takes place, for muscular action is undoubtedly the main cause of deformity, tonic action of the muscles existing under all circumstances, and spasmodic action when they are irritated by fragments and attempts at reduction.

This muscular spasm is the main cause of deformity and shortening of the limb, consequently it becomes an important point to recollect in the treatment of fracture that the peculiar deformity associated with any special form of fracture is obviated by neutralizing the action of the muscles that are prone to produce it. Thus, in fractures of the humerus above the insertion of the deltoid, the action of the latter muscle will be to draw up and outwards the lower fragment, the pectoral muscle having a direct influence in drawing the upper fragment in. In fractures of the humerus below the insertion of the deltoid the tendency will be to draw the upper fragment outwards, the brachialis anticus having an equally powerful tendency to draw the lower half forwards. In fractures of the thigh-bone below the minor trochanter the psoas and iliacus muscles naturally draw the upper fragment upwards and rotate it outwards, and in fracture of the condyles the gastrocnemii have a powerful tendency to draw the lower end backwards.

When a bone is simply fissured, and not displaced, the periosteum not being divided, there will be little displacement, and in children this condition is often found.

In all cases of supposed displacement the normal condition of the limb must be inquired into, and the sound compared with the affected one, for in more cases than one I have known a naturally deformed limb to have been mistaken for an accidental deformity, and attempts made to restore it, or rather to reduce it, to its supposed normal condition.

Crepitus caused by the rubbing of the ends of the broken bone together, as a sign of fracture, is most valuable, but it must not be looked for in all cases. When detected in making the examination of a broken limb the diagnosis is made, but when other symptoms of fracture are present sufficient for a diagnosis, crepitus must not be looked for; in all impacted fractures it can only be felt on loosening the impacted fragments and consequently by doing irremediable harm. In impacted fracture of the hip this error is a fatal one and should be avoided. In incomplete fractures crepitus is absent. In fact, the manipulation of every fracture should be very gentle, in order that as little displacement and local injury as possible may

be inflicted. To look for crepitus in all cases is unnecessary and injurious, for the bulk of fractures can be made out with certainty without. As a symptom, however, it is always of great value.

The crepitus of effusion or of the thecæ of tendons must not be mistaken for that of a broken bone. It is a soft crepitus rather than a hard one, as in bone. Bursal crepitation is particularly liable to mislead.

When some swelling follows immediately upon the accident, it means ruptured bloodvessels, arterial or venous. When it occurs within a few hours, it is due to inflammatory effusion.

Prognosis.—Simple fractures, as a rule, do well. At Guy's in six years, out of 469 cases of simple fracture of the thigh, 17 died, or 3.5 per cent.; of 888 examples of simple fracture of the leg, 8 died, or not 1 per cent.; of 123 cases of fractured patella there was no death.

The same statistics tell me that one-tenth of all cases of fracture of the thigh are compound, and one-fifth of all fractures of the leg.

Compound fractures are always serious accidents, those of the upper extremity being less fatal than those of the leg, and these less so than those of the femur. Thus, at Guy's, in six years, out of 94 cases of compound fractures of the arm and forearm, 16 died, or 17 per cent., or 1 in 6 cases; out of 202 cases of compound fracture of the leg, 56 died, or 27.7 per cent., or 1 in 4 cases; and out of 52 cases of compound fracture of the thigh, 19 died, or 36.5 per cent., or 1 in 3—the mortality increasing by 10 per cent. in each group. These figures will roughly indicate the risks of the different accidents.

TREATMENT.—The principles of the treatment of fracture are very simple, but the practice is often very difficult.

To restore a bone to its normal position, and to keep it there by means of surgical appliances, are simple rules to be observed, but to carry them out often demands the highest surgical skill and ingenuity, and yet the whole treatment of fractures is really comprised in these two indications; complications can only be treated as they arise.

In examining a fracture the greatest care is called for, and only sufficient manipulation should be allowed to enable the surgeon to make out the *seat* of the fracture, the *line* of fracture, and any special peculiarity of the fracture, that is, its *tendency* to ride in any definite direction: this special tendency is the one point the surgeon has to look to and remember in his treatment. These points should, moreover, be made out at the single examination prior to treatment, for repeated examinations, whether by the responsible surgeon or his assistants, are always to be condemned; they can only do mischief, by exciting more local irritation than is necessary, and adding to the risks of injury to the muscles and soft parts more than they had already sustained. For this reason, when a fracture is suspected to have taken place, the surgeon or bystanders should at the time of the accident be satisfied to bind the limb to some immovable apparatus, till the sufferer has been carried home and placed in the position in which he is to be treated.

A wisp of hay or straw, a bundle of sticks, two pieces of wood fixed by a handkerchief, are usually sufficient. When the lower extremity is the affected part, the injured limb may be bound to the sound one, the latter acting as a splint.

When the fracture is compound the same precautions are called for, and all bleeding is to be arrested by the application of a pad or bandage over the wound, kept on by means of pressure and the elevation of the limb. In more severe cases the tourniquet may be called for, or some local pressure over the main artery.

When these precautions are not observed on the field many simple fractures are turned into compound, compound fractures are made worse, and lives lost from hemorrhage.

When a patient is placed in bed where he is to be treated, the fracture is to be manipulated, and its *position, nature,* and peculiar *tendency* made out, and when made out it is to be "set," or put up, at once. The only exception to this rule is when time has been allowed to pass before treatment is commenced, and much œdema or swelling of the injured extremity exists; under these circumstances it is better to fix the injured limb upon a pillow, with a long sand-bag on either side to act as a splint, and possibly a third round the foot, the pillow and side sand-bags being firmly bound together by a strip of bandage, the whole forming an immovable apparatus. Mr. Aston Key, indeed, was so fond of this mode of putting up fracture of the leg that in my dresser days it was the usual mode of treating such fractures all through their course, that is, for the first month or five weeks, till they could be put up in some starch or other immovable apparatus, and the patient was allowed to get up. Such a plan is comfortable to the patient and a satisfactory one; it wants, however, closer attention on the part of the surgeon than can often be obtained.

In "setting" a fracture some care is needed, and in doing so the opposite extremity should always be before the surgeon as a guide; inquiries having been previously made as to the condition of the limb before the accident, whether it was deformed or shortened from some previous fracture or disease, congenital or otherwise, for I have known a leg that had been injured, violently and unnecessarily manipulated to restore a fractured bone to a position that it could not assume on account of some natural deformity, and a fractured thigh subjected to like rough treatment to bring it down to the level of its fellow, in which an irremediable shortening existed from a former fracture.

In extending a broken limb to restore the bones to their normal position the upper portion should be firmly held by an assistant—*counter-extension*—and the muscles attached to it relaxed by placing the limb in a slightly flexed position; a second assistant or the surgeon may then extend the fractured end, while the latter gently manipulates the fracture to make out its points. The extension should be steady and free from all jerks and violent movement, gentle lateral, rotatory, or other movements, being given when required to restore the displaced portion of bone; the pressure of the thumb or finger being freely used when the necessities of the case require it, to produce an accurate coaptation or setting of the fragments.

Where muscular spasm is so severe as to render it impossible to keep the fractured bones when restored *in situ*, a condition which is not uncommon in fracture of the leg, the tendon of any offending muscle may be divided, for there is no operation of greater value and attended with less evil results than the division of the tendo Achillis in otherwise intractable fracture of the leg. In a general way, however, the muscular spasm ceases after the first three or four days. At times the inhalation of chloroform is a valuable aid in the reduction of a fracture. When much swelling exists the "setting" of the fracture must be postponed for a few days till it has subsided, requiring, perhaps, seven or ten days, but these cases are very exceptional.

When the fracture has been reduced, and the broken fragments by manipulation coaptated or "set," splints or other mechanical appliances are called for to keep the bones in their normal position, and the simpler these appliances are—so long as they fulfil their purpose—the better. The splints should always be well padded, and the pads should be so adjusted

as to fit into the inequalities of the limb, and protect the limb from any local pressure. They should be firmly and immovably fixed to the limb by inelastic straps or bandages, and the seat of fracture should, as a rule, be left exposed for the surgeon's examination, in order that the fracture may be readjusted should displacement take place. To cover up by bandages a broken bone is to render uncertain what should always be certain—the position of the bone during the progress of repair. Pott's rule, that the splints should include the joint above as well as below the fracture is a sound one; but it cannot always be followed. Every joint should, however, be fixed when by its action the broken bone is rendered movable.

When double bones exist and one alone is broken, the other acts as a splint and keeps up extension. Under these circumstances a simple apparatus is alone required to keep the fractured bone quiet and restrain the action of the muscles that move it, for it is, as has been said, this muscular action that tends to draw the lower fragments of a broken bone into some abnormal position, and gives rise to shortening, and by keeping up movement in the broken bones retards repair.

Extension is consequently a valuable and necessary adjunct to other treatment, and the extension by means of weights and pulleys, or other appliances, such as the ingenuity of the surgeon may suggest, are of great value. These means will be given in the treatment of special fractures.

After the setting of the fracture the essential points to be observed in the treatment are the immobility of the broken bone, extension and counter-extension when needed, and its exposure to observation during the progress of repair to render certain the maintenance of the bone in the desired position.

The treatment of compound fractures is similar to that of the simple, plus the treatment of the wound and its complications, and the treatment of the broken fragments or projecting portions of bone.

The fractures are to be set as in the simple, greater care being observed in the manipulation, if possible, that the soft parts are not more injured; the bones are to be as immovably fixed by means of splints—interrupted splints being often required—loose fragments of broken bone are to be taken away, and projecting portions of bone excised; the wound, to aid reduction of the bone, may be sometimes enlarged; it is to be thoroughly cleansed, and all vessels twisted or ligatured, the wound being sealed by means of a piece of lint saturated with blood, or, with what is as good, the compound tincture of benzoin. In the present day the carbolic-acid dressing, after Lister, has strong advocates, the wound having been well washed with a weak solution of the acid, one part in a hundred.

When the soft parts are much crushed, and the large vessels and nerves injured, amputation may be called for, more particularly in old subjects. In some joints, such as the elbow or ankle, excision may be the best practice.

In compound fractures “scarcely any amount or form of fractured bone alone,” writes Skey (“Operative Surg.”), “would justify the immediate resort to the knife if taken singly, even supposing the bone fractured extensively into a large joint; for in such a case, although ankylosis of the joint would probably occur, it would prove a lesser evil than that of amputation. Superadded to a compound or comminuted fracture of bone, the injury may be rendered yet more serious by extensive laceration of the muscles. In considering this latter condition much will depend on the kind of laceration, whether the muscles are merely cut asunder, or whether contused and torn, and whether this injury involves a few only or the majority of the muscles of the limb. Again, we must examine with great care

the condition of the vessels. Is the main trunk whole? we might ask, in the supposed case of fracture of the thigh; or in that of the leg, is the posterior tibial artery torn? Is the limb colder than its fellow, or is the temperature considerably lower than the rest of the body? If so, probably one or more arteries are divided. What is the condition of the nerves? Does sensibility extend to the toes? If not, probably the nerve is divided also. If the evidence of the integrity of both artery and nerve fail, and the sinking temperature of the limb and the loss of sensibility continue to increase, we have no alternative but amputation."

If a doubt exists in the mind of the surgeon on the necessity of *immediate* amputation, let him wait, unless the patient be old, when let him act.

Simple fractures into joints require special treatment, for in a large number of cases, although not in all, some impaired mobility of the joint will ensue; for this reason the joint itself is to be fixed and placed at the most useful angle.

Compound fractures into joints generally demand excision or amputation. In the upper extremity excision is doubtless the better operation where there is any hope of saving the limb.

In the lower the expectant treatment is certainly better than excision, and probably better than amputation where the parts are not so injured as to render amputation a necessity, and the age and general condition of the patient justifies an attempt to save the limb; but these points will again have to be considered amongst the *spécial* fractures. In gunshot wounds these views are now generally entertained.

The Fracture Bed.—The best is, without doubt, a good horsehair mattress placed on a bedstead with a firm bottom; where this does not exist, a board slipped beneath the mattress is a good substitute. A canvas bottom, however tightly corded, always yields, and a feather or spring bed is not to be sanctioned.

In fracture of the lower extremity the head of the patient should not be raised too high, the use of one small pillow being ample.

The sheet covering the bed should be kept carefully stretched tight, so that no "ruck" takes place, bed-sores being more frequently caused by such than by pressure. The sheets should not be changed more often than is absolutely required, although they should be smoothed or rather stretched, several times daily.

Splints made of wood, iron, or perforated zinc, may be employed; the different forms will be given when the special fractures are considered. As a rule, the simpler they are in construction the better; before adapting one to the broken limb it is well to fit it to the sound. The splints should be quite clean.

Pads.—All splints should be well padded, and their edges carefully protected. The pads should consequently be well fitted and broad, overlapping the sides. The best materials for pads are tow or fine oakum, cotton-wool, or sheep's wool, or strips of thick flannel, inclosed in a casing of soft linen or lint. The pads should be first fixed to the splint by tapes, or, by what is better, some pieces of strapping.

Besides wooden and iron splints, what the French called the "immovable apparatus" for fractures is a very favorite one, and the material employed may be left to the fancy or convenience of the surgeon.

In fractures of single bones, such as the fibula or tibia, where no displacement exists, such a mode of treatment is very valuable, the limb being put up a few days after the accident, as soon as the swelling, &c., has subsided. In other cases it is not expedient to employ it for at least ten or fourteen days, not, indeed, till swelling has subsided and a certain amount

of repair has taken place. In the fracture of long bones, such as the femur, it is better to postpone its application till union is complete. Some excellent surgeons, however, employ the immovable apparatus from the very first, and amongst them Erichsen. The mode of its application is as follows: In all cases the limb should be cleansed and carefully dried, the bone itself being well protected by cotton-wool or a flannel bandage. The bandage, with the stiffening material, is then to be prepared, and it should be put on as smoothly as possible, no more "turns" being employed than are absolutely necessary.

Splints of gutta-percha, millboard, leather, Cocking's poroplastic felt, Hyde's felt, or perforated zinc, may be employed as additional supports when complete immobility is demanded. The latter's felt, or perforated zinc, are what I prefer. The first five materials, after having been cut to pattern, should be beforehand well softened by immersion in hot water and then moulded to the limb; the zinc should be carefully cut to fit it, and well adjusted. These splints should then be applied over the cotton-wool or flannel bandage, and the prepared bandage then bound round; when starch is used (Seutin's bandage) it should be freely painted with a brush over each turn and lastly over the whole exterior, two or three coats being employed. The same may be said when the *white of egg* or *dextrine* is employed. When *gum and chalk* are used the same mode is to be followed, the mixture consisting of equal parts of finely powdered gum and chalk made into the consistence of thick paste by the addition of boiling water gradually stirred in. This bandage is far more solid than the starch.

Mr. De Morgan prefers the *glue bandage*! the best French glue, after having been soaked in cold water and melted in a glue pot, being used, the addition of about one-fifth of the bulk of the solution of methylated spirits being useful to hasten the rapid drying of the glue.

When *plaster of Paris* is employed the bandage should be of some loose texture, that made of book muslin is probably the best. The bandage may be prepared beforehand by rubbing the dry powder well into its texture, the bandage being thoroughly wetted in a bowl of water for two or three minutes before it is used, some additional plaster made with water into a cream being painted over the bandage as it is unrolled to strengthen the whole. In other cases, where the bandage is applied dry, the dry plaster may be rubbed into the bandage after it has been wetted.

When the bandage is not prepared the same plaster cream may be painted over the roller as it is unrolled, the roller being applied wet.

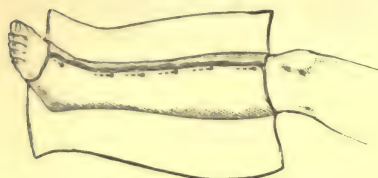
When the surface is an extensive one the setting of the plaster may be delayed by the addition of a little size to the water with which it is mixed, or by a little stale beer. Salt and the use of warm water increases the rapidity with which the plaster sets.

The day following the application of this bandage a coating of flour, paste, or gum, may be applied to prevent chipping, or even a coating of varnish.

In the appendix to the "Army Medical Report" for 1869 Mr. Moffitt describes the Bavarian mode of putting up a fracture in an immovable apparatus, which deserves a better knowledge than it possesses. I have tested it well and can strongly recommend it; it is simple and rapid in its application, and most effective. Two pieces of flannel, suited to the length and circumference of the limb, are cut sufficiently wide to overlap slightly in front. When so prepared, they resemble the leg of a stocking cut vertically. One is now laid over the other, and they are stitched together from top to bottom down the mesial line, like two sheets of note-paper stitched at the fold. They must now be spread out under the injured limb

so that the line of stitching corresponds to the back of the calf. The two inner leaves, so to speak, are now brought together over the shin (Fig. 408), and fastened by long pins, the heads of which are bent, or stitched.

FIG. 408.



Bavarian or flannel immovable splint.

The leg being held firmly, an assistant mixes the plaster with about an equal bulk of water, and rapidly applies it, partly with a spoon, and partly by pouring, over the outer surface of flannel covering the limb. The two portions of the second layer are then quickly brought over so as to meet, and the inequalities in the distribution of the plaster are removed before it hardens by smoothing with the hand. In about three minutes the gypsum sets and the limb is incased in a strong rigid covering. The edges of the flannel can be trimmed and the pins removed; a couple of straps, or a few turns of the roller, make all secure. In order to take the apparatus off it is only necessary to remove the straps and separate the edges of the flannel, when the two sides will fall asunder, the line of stitching behind acting as a hinge. In cases of compound fracture an opening suitable to the wound may easily be made. My dressers have been in the habit of using gum and chalk instead of plaster, and it answers well; it takes longer to dry than plaster. This splint is as good for joint cases as for those of fracture. It is by far the best immovable apparatus we possess.

Mr. Hide, of Mortimer Street, has introduced a "leather felt splint" of great value; it is readily applied, light and strong; it is rarely required to be used with starch. Cocking's poroplastic splint answers the same purpose; the splint readily becomes soft on immersion in hot water, and hard again within a few minutes of its removal; if, when moulded, it fails to fit exactly, it can be softened locally by the application of a hot-water sponge.

Mr. L. Tait ("Med. Times," 1865) has suggested the use of paraffine for the same purpose, the melted paraffine being kept liquid by the immersion of the bowl containing it in hot water, the bandage, as it is being applied, being made to pass through the liquid paraffine melting at 105° to 120° F. Two or more coats of paraffine may be painted over the whole.

The liquid glass—*silicate of potash*—may also be used, the solution being painted over the bandage with a brush; those who have used it speak very highly of its value.

By way of caution it should be stated that all starch, chalk, and plaster of Paris splints contract on drying, and from such contractions I have known harm, and even gangrene, follow. To guard against this contingency, when bandages are used, the free use of cotton-wool around the limb should be employed. In the Bavarian splint this precaution is not called for.

On this account the practice of using these splints, as a primary application in the treatment of fractures, is dangerous; for when swelling to any extent takes place the pressure may be most harmful.

When pain or swelling of the limb follows the application of any of these splints they should be at once removed, the whole being cut up, from end to end, with strong scissors, eyelets being subsequently introduced for laces to draw them together again, or straps and buckles may be employed.

Repair of Fractures.—In children broken bones repair rapidly, four weeks being ample time for the whole process to be perfected; in the old, ten weeks or more may be needed. When the broken ends of the bones

are placed and kept in position, repair goes on more rapidly than when they are apart or not kept at perfect rest. When bones are maintained accurately in position, or are impacted, direct union takes place, as in the soft parts; when some degree of movement is allowed, reparative material is poured out around the broken fragments, the provisional callus of authors, or the ensheathing callus of Paget, acting as a temporary splint to keep the bones in position till repair has been effected by means of the permanent callus through which the broken bones are united. When provisional callus, therefore, exists, some mobility of the broken bone, to a certainty, has been allowed, the best repair of a fracture being the direct one without any such temporary splint. This addition to our knowledge is due to Paget, for until his day a provisional callus was always looked upon as a necessary means for the repair of every fracture. We now know it is only present when mobility of the fragments interferes with direct repair; it is well seen in the clavicle and ribs.

When a bone is broken blood is effused, the amount depending upon the degree of injury the soft parts have sustained and the amount of comminution of the broken bone, it being exceptional to find blood between the broken bones. In simple fracture the periosteum may be only torn across; in the comminuted it is more extensively injured. In incomplete fractures it is probably always entire.

After the accident some slight inflammatory exudation may be poured out around the broken bone, but in healthy subjects this is very limited, and is unattended by any constitutional symptoms. In more complicated cases, or in cachectic subjects, the effusion may be extensive, and constitutional symptoms severe, febrile disturbance being present.

Under favorable conditions this inflammatory material will be absorbed with the effused blood, and about the sixth or ninth day true reparative material is poured out. When no displacement exists this will be effused only between the ends of the broken bones; when the bones are comminuted it will be more diffused; and when they are misplaced it will be still less defined; when the periosteum is much separated or torn it will be poured out all around the bones as a provisional callus. The true reparative products are chiefly poured out by the periosteum and endosteum, the soft parts around at times adding their quota. In some cases, more particularly with the flat bones, the ossification of this reparative material has a preliminary fibrous tissue stage; in the long bones, after the blood has been absorbed, the cell infiltration of the tissues passes on to the formation of connective tissue, and this connective tissue or *neoplasm* subsequently ossifies, in rare cases passing through the stage of fibro-cartilage. In children it is probable that the cartilaginous stage always precedes the osseous; in adults the bone is poured out at once; in rapidly repairing fractures this is probably always the case.

Ossification may take place in the periosteal blastema, or in the endosteal, or in both, these points being greatly determined by the relative position of the broken ends of the shaft of the bone and the comminution of the fragments, great displacement and separation being bridged over or cemented together by irregular masses of connecting bone-tissue.

When mobility of the broken bones exists the bone-cement or provisional callus is very extensive, and in the ribs, where it is impossible to prevent movement, the provisional or ensheathing callus always exists, Dupuytren's ring of provisional callus being constant. In the clavicle it is also common, and in other bones according to the amount of movement that has been allowed in their treatment.

When the movement is great the process of ossification will not go on

kindly, and ligamentous or fibrous union will remain, an ununited fracture being present; at times a false joint is formed. A splendid example is figured in another page (Fig. 409). The rapidity with which ossification or true bony union is obtained depends greatly upon the amount of quiet the broken bones are favored with, and on the constitutional power of the patient.

The data concerning the times in which the several parts of the reparative process are usually completed after fractures of adult human bones may thus be reckoned, according to Paget: To the second or third day after the injury, inflammation in and about the parts; thence to the eighth or tenth seeming inaction, with subsidence of inflammation; thence to about the twentieth production of the reparative material, and its gradual development to its fibrous or cartilaginous condition; thenceforward its gradual ossification, a part of the process which is most variable in both its time of commencement and its rate of progress, and which is probably rarely completed before the ninth or tenth week.

In open or compound fractures repair goes on very much in the same way as with simple fractures, and when made simple by sealing the wound precisely in the same way. When the wound is left open and suppuration takes place around the broken fragments and in the soft parts, repair goes on through granulation, the granulations ossifying, the connective-tissue cells passing into bone-cells, the process of repair being more gradual than where the reparative material is poured out between the broken bones and goes on directly to ossify.

When the inflammation is severe, and the broken fragments die wholly or in part, repair is retarded, and until the necrosed bone has been cast off or removed it cannot be perfected. In comminuted compound fracture this result is more common than in less complicated cases.

In gunshot wounds and injuries of bones this comminution of the bone is the chief point of difference between them and other compound fractures.

Compound fractures, as a rule, require for repair three or four times the period required in simple fractures.

Ununited fractures occur when, from any local or general cause, ossific union is delayed or does not take place between the broken ends of the bones, and in by far the bulk of cases this is the result of a want of that complete rest and quiet which is so essential for the ossific union of a broken bone. When the ends of the broken bone are kept asunder ossific union is sure to be retarded or to be prevented. When any muscle or fascia is placed between the broken fragments the same result may be experienced, and in feeble cachectic subjects the same want of repair may be met with.

An ununited fracture unquestionably depends upon some defect in the formative powers in the bone, no reparative material being poured out; or upon some accidental hindrance to the perfection of the normal reparative process, as when fibrous union takes place and fails to ossify.

These failures in the reparative process depend upon some failure in the general power of the patient, or some want of care in the local treatment of the case, or upon some local cause: the union is, as a rule, simply delayed.

Hamilton calculates that such delayed union occurs once in 500 cases, but this average I believe to be too high. It is mostly found, according to Norris ("Amer. Jour. of Med. Sciences," 1842), in the thigh, leg, arm, forearm, and lower jaw. I have once seen it in the clavicle, once in the ribs, and cases are recorded in which it was met with in the spine.

In the majority of cases the union of the broken bones is by fibrous tissue, this tissue failing to ossify: in Prep. 1110⁸⁰, Guy's Museum, this condition is well exemplified, the ends of the bone being pointed and firmly joined by ligamentous tissue. The length of this tissue varies in different cases. In *exceptional* instances a false joint is formed, the ends of the bone being rounded and inclosed by a strong capsular ligament; this is well seen in a specimen of fracture of the forearm (Guy's Museum, 1119²⁰), but still better in that of the humerus (Prep. 1110⁸⁵, Fig. 409); the ends of the bone are studded with fibro-cartilage, and complete movement existed.

In still more rare cases there is a total absence of all uniting medium.

TREATMENT.—Assuming that in a large majority of cases of ununited fracture, the want of union, or delayed union, is simply the result of a want of that absolute immobility of the fractured limb which is so essential for the repair of any fracture, an absolutely immovable apparatus is the most essential point to be observed, and this is usually to be supplied by the application of some form of splint, such as the starch, egg and flour, chalk, plaster of Paris, or liquid glass, with gutta percha, millboard, zinc, or felt splints, the joints above and below the broken bone being included in the apparatus, tonic constitutional treatment being at the same time observed.

When the limb is firmly fixed in this way rest and the non-use of the limb is hardly necessary; indeed, under certain circumstances, the moderate use of the limb seems to be beneficial, and in several cases under my care repair seems to have been hastened by such a license; upon a somewhat similar principle, when these means fail, the ends of the bone may be well rubbed together to excite action before the reapplication of splints, and in still older cases the bones may be drilled and fastened together by means of wire sutures or ivory pegs, the credit of this latter valuable suggestion being due to Dieffenbach. Dr. Physick, of Philadelphia, years ago (1804) suggested the introduction of a seton between the ends of the broken bones; good success has been said to have followed the practice, Norris reporting that such treatment succeeded in 54 out of 72 cases. The object of the treatment is to excite local action between the fragments, and when this is secured the seton may be removed. With the same view Maligne introduced acupuncture needles between the bones. Miller and M. Blandin scraped subcutaneously the ends of the bones, or the connective tissue, with a tenotomy knife.

Resection has also been practiced, and, according to Norris, with success, in thirty-seven cases out of sixty-four. The operation is, however, a formidable one, and should only be undertaken in exceptional conditions—in very old cases, where all hope of minor measures is not to be entertained, where the ends of the fragments are far apart, and where the condition of the limb is such as to render some risk justifiable to gain the desired end.

Dr. H. J. Bigelow, of Harvard, has, however, met with considerable success in detaching the periosteum from the extremities of the affected bone for about half an inch, and separating the muscles with it, taking off the ends of the bones, and securing the resected portions together by strong wire

FIG. 409.

False joint
in HumerusPrep. 1110⁸⁵, Guy's Mus.

passed through half the thickness of the shaft of either fragment; the periosteal flaps may also be united by sutures. The limb is then fixed on a splint. The wire may be left in place without fear from two to six months. He cured ten out of eleven cases in which this operation was performed. ("American Quart.," 1867.)

At times it happens that a fracture that has united becomes disunited from some feeble condition of health—after fever, scurvy, or other cause. I have had one very marked case of this in the person of a young lady who had her thigh fractured abroad, and became the subject of tropical fever, the bond of union completely giving way. She subsequently, however, obtained a firm limb. In such cases if treated by local immovability and constitutional tonics, &c., ultimate union is to be looked for. They are to be classed with others in which the cicatrices of burns or old ulcers break down under some enfeebling influence, and which heal under tonic and general hygienic treatment. In the treatment of all these cases time is not to be estimated too closely.

The deformities that follow badly united fractures at times require surgical treatment, and when the surgeon is consulted during the first few weeks of the case chloroform should be given and the bone refractured and set in a good position, it being quite justifiable to employ considerable force to attain this end. In young subjects this refracture is rarely attended with difficulty; in the adult some is usually found. Cesterlen and Skey were strong advocates for this practice, the former surgeon having employed it up to the twenty-fourth week, and the latter on a boy, æt. 15, thirteen months after the fracture.

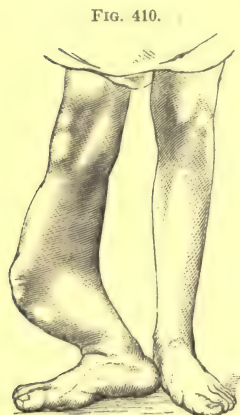


Fig. 410.
Deformity following repair of green-stick fracture.

When the bone has united too firmly to permit of refracture, it may be divided by a subcutaneous section, when possible, or by some cutting operation. Key did this latter operation in the leg, in 1839, ("Guy's Hosp. Rep.," series i, vol. iv), and more recently Lister has done the same ("Brit. Med. Journ.," 1868). The subcutaneous section is to be performed in a similar way to that adopted by W. Adams in dividing the neck of the thigh-bone, as described in page 770.

These operations are, however, only to be undertaken when the local deformity is great and the limb useless.

In the incomplete or green-stick fractures of infancy, if the bone be not straightened strange deformities ensue. In the case depicted in Fig. 410 such a result was to be seen, the bent tibia and fibula having been much thickened by the deposition of bone in the concavity of the arch, the bone measuring across its centre six inches. It was taken from a girl twelve years old.

CHAPTER LXXX.

SPECIAL FRACTURES.—FRACTURES OF THE UPPER EXTREMITY.

FRACTURES of the cranium and spinal column have already received attention.

Fractures of the ossa nasi are not uncommon, and this accident may be complicated with other injuries, simple or compound. When the result of a severe blow it may be associated with a fracture of the base of the skull, and in Fig. 7, page 62, will be seen a drawing of a case in which this complication existed. I have also recently had under care a man with a compound fracture of the nose, and a fracture of the upper jaw into the orbit, some subconjunctival hemorrhage below the eyelids existing to mark the injury, in addition to the mobility of the broken bone. The accident was caused by a piece of timber falling on the upturned face. All these cases may be complicated with hemorrhage, but it is rarely severe. The best treatment is to carefully adjust the broken bones by means of dressing forceps or a female catheter introduced into the nostril, aided by manipulation and some light dressing; and plugging of the nose to keep the bones in position is useless and injurious.

Fractures of the *upper jaw* and *malar bones*, &c., are also met with; they are always the result of direct blows. With Dr. Hunt, of Hoxton House, I lately saw a lunatic who had received from another madman a blow with the fist on the right cheek; a severe fracture of the upper jaw resulted, separating the right alveolar process from behind forwards to the canine tooth; the lower jaw was fractured in addition below the right condyle and in the left ramus; the deformity was great. Fracture of the malar bone also occurs.

In the treatment of these cases considerable difficulty is often experienced in keeping the broken fragments together; they should be moulded by manipulation as carefully as possible, and kept in position by any means the ingenuity of the surgeon may devise, pads, strapping, and wire, being useful materials. In fractures of the upper jaw, involving the alveolar process and palate plate, the application of a metal or gutta percha plate adapted to the palate by some experienced dentist is to be thought of. My friend and colleague, Mr. James Salter, has treated several such cases with marked success. When the teeth are loosened they should not be removed, as they may subsequently become firm.

Fractures of the lower jaw have been described in page 268.

Fracture of the Clavicle is generally the result of indirect violence, such as a fall upon the shoulder, more rarely direct from a blow. When direct it is usually compound or comminuted. Hamilton and Gurlt record examples from muscular action, and I have seen it in a man, æt. 44, who had had syphilis nine years before, from simply lifting a heavy weight from the ground, the bone breaking near the sternal end with a snap; good recovery followed. The case was brought under my notice by Mr. Couling, of Brighton, who was then house-surgeon at Guy's. The statistics of the Middlesex Hospital, as given by Messrs. Flower and Hulke, in Holmes's "System," vol. ii, compiled from the experience of sixteen years, prove it to be more frequently broken than any other single bone, the radius stand-

ing next in order, although, including fracture of the radius with the ulna, the fracture of the clavicle stands second. Half the recorded cases occurred in children under five years of age.

The bone is, as a rule, broken about its centre, although fractures of either extremity are met with. The line of fracture is usually oblique, and the inner fragment has commonly a tendency to ride over the outer, the outer falling downwards.

The *symptoms* are generally well marked. Inability to move the arm freely, with pain in the attempt, are always present, the patient supporting the arm of the affected side. On comparing the shoulders on the two sides, the joint on the affected side will be seen to be placed lower and more forward than on the sound one, and to be drawn nearer to the median line of the body where the displacement is great, even for one inch. On passing the finger over the broken bone some depression and corresponding elevation of the broken fragments will be made out, with the effusion of much solid material when the examination is made after the expiration of days. *Crepitus* is sometimes to be detected, but it need not be looked for, this symptom, with the amount of displacement, depending much upon the line of the fracture and its situation.

Dr. R. Smith, of Dublin, points out ("Treatise on Fracture," 1850) how in fractures of the acromial end of the bone, between the conoid and trapezoid ligaments, there is scarcely any displacement of either fragment, the diagnosis being made by the pain produced on pressure over the broken point, and the crepitus educed by the movement of the bones in opposite directions through the fingers. He also shows how in fracture external to the trapezoid the displacement is great, the inner fragment being drawn upwards by the trapezius muscle.

In children *incomplete* fractures of this bone probably occur (Fig. 405).

Fractures of the clavicle are sometimes comminuted and compound, and occasionally complicated with some severe injury to the vessels beneath. In the late Sir R. Peel a pulsating blood tumor appeared after the accident, which was supposed to have been due to a rupture or laceration of some large vein, probably the subclavian, while from the severe pain that attended the injury some of the nerves of the brachial plexus were believed to have been injured. At St. George's Hospital there is a specimen in which the end of the fractured bone was driven through the internal jugular vein.

Fracture of both clavicles have also been recorded. I have seen this more than once in children.

TREATMENT.—Daily experience proves that fractures of the clavicle unite without any treatment, and too often that where treatment has been employed the union is not more perfect nor satisfactory, for deformity almost always exists in spite of treatment, and in no fracture has a greater diversity of means been employed. Daily experience likewise proves that in most, if not all, fractures of the clavicles the bones fall well into place on the patient assuming the recumbent position. In young ladies, and in others where it is a matter of importance to prevent deformity, this recumbent position in bed may be maintained for about three weeks till union has fairly taken place; but children and men will rarely be found to follow such a line of treatment, and happily it is not required, for nearly, if not quite equal benefit will be secured by imitating what takes place on the patient assuming the recumbent position, and that is by fixing the lower blade of the scapula to the chest, binding down its angle to the thorax, and thus preventing the tilting forwards and rotation of the bone through which the deformity takes place.

The plan I have now for some years adopted is to place a pad over the

blade of the scapula below its spine, and to bind the bone firmly to the thorax by means of broad strips of strapping obliquely encircling half the chest, from the spine to the sternum, at the same time supporting the affected arm in a sling, drawing the hand upwards towards the opposite shoulder. This same method is also advocated by Dr. E. Hartshorne, of Philadelphia. Whilst the strapping is being fixed the scapula should be well tilted backwards by elevating the arm, or the patient should be kept in the recumbent position. When this practice cannot be followed the elbow should be brought forwards to a point below the nipple of the affected side, and the hand drawn over the opposite shoulder. The old plan of fixing the pad in the axilla and the figure-of-eight bandage is a delusion, and a very uncomfortable one.

The axillary pad of Desault is, at times, of value and may be employed, the pad being fixed by a broad piece of strapping made to encircle the shoulder. In addition to the pad Professor Gordon, of Belfast ("Dublin Quart.," 1859) recommends the injured arm to be extended downwards and firmly fixed to the body by a bandage, permanent extension being kept up by means of a band fastened above to the forearm flexed at right angles, and below around the perineum or upper part of the thigh.

Fractures of the scapula are, probably, always the result of direct violence, although when a fracture of the neck occurs, a fall upon the shoulder may be its cause.

The *body* of the bone may be fissured in any direction (Fig. 411), much displacement being rare; at times, however, it occurs, the muscles inserted into the broken fragments producing the displacement.

Mobility of the broken bone and crepitus may usually be made out by manipulation; but in fat subjects, and when effusion exists the diagnosis may be difficult.

TREATMENT.—A broad pad carefully adjusted by means of broad strips of plaster encircling half the thorax are usually sufficient means to employ, the arm being kept quiet and the elbow raised in a sling. A good shield of gutta percha or felt may likewise, at times, be of use.

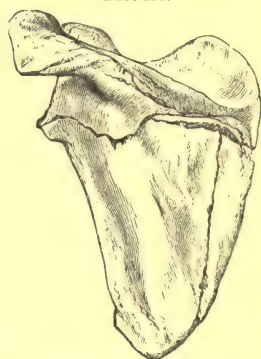
Fracture of the *acromion process* is met with across its base or in any other part, the outer fragment being generally drawn downwards with the arm, producing a dropping of the shoulder; it is readily made out on tracing the spine of the scapula outwards, by the deformity, the break in the normal line of the bone, and local pain, if not separation of the fragments. There is also loss of power in the arm and alteration in its outline.

It is to be treated by raising the elbow by means of a good sling or a bandage, a small axillary pad at times being of value, and a circular bandage binding the arm to the thorax. The union is often ligamentous, it being impossible to keep the fragments of bone closely in apposition.

Fractures of the *coracoid process* are remarkably rare. I have seen but one instance, in a girl, *æt.* 15 or 16, as the result of a blow. There was local pain and crepitus to denote the injury, with displacement of the process, its point being drawn downwards by the biceps muscle, and its base projecting. It is more commonly associated with dislocation of the humerus.

TREATMENT.—The muscles attached to the process must be relaxed, the biceps by flexing the forearm, and coraco-brachialis by drawing the arm

FIG. 411.

Prep. 1097²⁰, Guy's Mus.

forwards and inwards. In this position the arm is to be bound by a bandage, the bone itself, if possible, being restored to its normal position by manipulation.

Fractures of the *neck of the scapula*, or of the *glenoid fossa*, must be rare. Sir A. Cooper described such cases, but since Malgaigne showed how the symptoms described might be produced by dislocation of the shoulder, with fracture of the glenoid cavity, some doubt has been thrown upon the question of a simple fracture of the neck of the bone ever occurring. In the Guy's Museum, prep. 1097⁸⁵, there is a specimen of fracture of the neck (Fig. 412), and in the Royal College of Surgeons there is a second, the third being recorded in Du Verney, "*Traité des Maladies des Os*," 1751. Sir A. Cooper gives the flattening and sinking of the shoulder, the prominence of the acromion, the elongation of the arm, and the presence of crepitus, as the chief symptoms, the head of the humerus being felt in the axilla. He also relates how the arm may be replaced in its normal position, and again displaced on allowing the arm to

FIG. 412.



Fracture of the neck of the scapula.

drop, this symptom being the chief one of diagnosis between the supposed accident and dislocation; but when dislocation of the head of the humerus exists with fracture of the glenoid fossa the same symptoms are found. This subject, therefore, requires more elucidation.

In suspected cases of this kind the elbow should be raised, in order to press the head of the bone well upwards into position, and kept there by sling and bandage.

Fractures of the humerus form about one-seventh of all fractures, being about half as frequent as fractures of the clavicle and scapula together. They may be divided into fracture of the *head and tuberosities*, *shaft*, and *condyles*. They are commonly the result of direct violence, occasionally of muscular action.

Fractures involving the *head and the tuberosities* are usually the result of direct violence upon the shoulder, such as a blow or a fall; occasionally they follow falls upon the elbow. In all cases the direction of the violence is an important point to make out, for by it the surgeon gets the best guide as to the position of the fragments and the nature of the injury.

FIG. 413.



Poland's case.

Occasionally the line of fracture follows that of the *anatomical neck*; it is then said to be *intracapsular*; such cases are, however, very rare. When it occurs the head of the bone may be completely separated and left as a foreign body in the joint. In other cases, such as Fig. 413 illustrates, the head is separated and the tuberosity fractured; more commonly, however, the fracture is an *impacted* one, the lower fragment being driven into the head of the bone, or the head driven into the neck, the greater tuberosity, as a rule, being broken (Fig. 414). Dr. R. Smith, of

Dublin, states that when this accident exists the arm is shortened, the acromion process projects, the shoulder has lost its rounded form, the shaft of the humerus has approached the acromion, and the head of the bone cannot be felt; when the tuberosity is broken off, crepitus may be detected.

I saw such a case in 1868, in a woman, *æt.* 59; the accident—a fall on the shoulder—had occurred nineteen days before, and the case had been

treated as one of contusion. Three-quarters of an inch shortening existed in the arm, and a distinct prominence of bone between the acromion and coracoid processes, with thickening; the head of the bone rotated freely in the glenoid cavity. There was some flattening of the deltoid. A good recovery took place, with permanent shortening. I saw also a like case in 1865, in an old man *æt.* 82, in which good repair took place.

More commonly a fracture about the head of the bone means a *fracture in the line of the epiphysis, or a separation of the epiphysis*, the epiphysis including the head and the tuberosities. This accident is generally the result of a fall upon the elbow; the symptoms of the accident are tolerably distinct. The head of the bone is to be felt in its normal position, but it is not moved on rotating the shaft, the end of the displaced shaft is usually sent forward. When fractured it presents a sharp edge and outline; when displaced—an accident that can only occur in subjects under twenty-one—the end of the bone appears rounded and slightly convex; it is, moreover, drawn forward by the action of the pectoral muscles, and made to project beneath the coracoid process in a marked and characteristic manner. In Fig. 415 this is well seen; it was taken from a male patient of mine, *æt.* 16.

When the separation is complete the displacement will be very marked. When partial it will be equally characteristic, but in partial dislocation of the shaft some mobility of the head of the bone will exist. In this accident the shaft may be at times replaced by manipulation, "but the moment the parts are abandoned to the uncontrolled action of the muscles the deformity recurs." (Smith.)

When impaction exists of either fragment no crepitus will be felt unless forcible movement be made, when it may be elicited. Care must, however, be observed in seeking for this information; for a forcible separation of the impacted bones is a fatal error; the nature of the accident, the shortening of the limb, the absence of crepitus, and the movement of the head of the bone on making gentle rotation of the shaft, being sufficient symptoms for diagnosis.

In fractures of the *anatomical neck*, when the head of the bone is driven into the tuberosity and shaft, as in all other forms of impacted fracture, union will go on if the surgeon takes care that the impacted bones are not displaced by manipulation. The surgeon, to gain this end, has only to apply some simple splint, such as an anterior and posterior or lateral, to maintain rest. In fracture or separation of the epiphyses, when the bones have been replaced, union may take place should the bones be held in position by splints. In the case illustrated in Fig. 415 a capital arm existed.

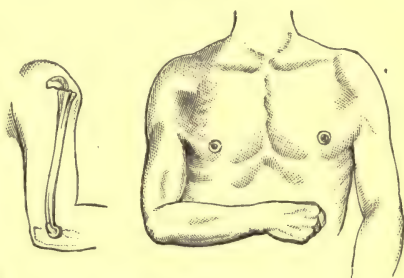
Fracture of the *surgical neck of the humerus*, below the tuberosities, is, however, probably the most common form of accident, the line of fracture

FIG. 414.



Greater Tuberosity
Prep. 1113^m, Guy's Mus.
Impacted fracture of
the head of the humerus.

FIG. 415.



Separation of shaft of humerus from upper
epiphysis.

being transverse or oblique (Fig. 416). In this fracture, when the bone is broken above the insertion of the pectoral muscle—its usual seat—the lower fragment is drawn *inwards* towards the chest, whilst the muscles that are inserted into the tuberosities tend to draw the upper fragment upwards and *outwards*. The more oblique the line of fracture the greater the deformity, the bone projecting forwards or backwards according to the direction of the fracture, and this direction depending greatly upon that of the force. Impaction of the broken fragments may occur in this fracture as in the last, the lower one usually penetrating the upper.

FIG. 416.

Prep. 1107³⁷.

When, after a separation of the epiphysis or fracture through the tuberosities or neck of the bone, the upper end of the lower fragment is drawn inwards and forwards by the pectoral muscles, the case may simulate that of dislocation; the mistake should not, however, be made when

all the symptoms of the case are considered.

In the early period of the accident the error ought not to be made, for the increased mobility of the bone and the crepitus are enough to indicate its nature; in the later period, when the deformity is visible as produced by the end of the lower fragment, the mistake may be made. The knowledge, however, of the fact, and the nature of the accident, ought to be enough to prevent error.

TREATMENT.—The nature of the accident, the tendency of the fracture, and the question of impaction or non-impaction being made out, the treatment becomes simple; in the *impacted* fracture, whether of the anatomical or surgical neck, the surgeon's aim is to keep the impacted bones in position and to prevent their being loosened. Natural processes effecting a cure in a month or six weeks with a limited degree of deformity.

In a *non-impacted* fracture the surgeon's aim is first to bring the bones into as good a position as possible, and to keep them there by means of splints and position. In doing this the tendency of the fracture has to be considered, and as a rule it is for the lower fragment to be drawn inwards by the pectoral muscle and the upper fragment outwards by the scapular muscles. To neutralize this the best plan is to put the arm up in a long inside splint from the axilla downwards, and an outside splint, binding the two well together. Simply to place the forearm in a sling and to bind the arm to the side is a dangerous practice. When much injury to the soft parts exists, or any wound, it is an excellent plan to draw the arm outwards from the body at half a right angle, resting it upon a splint, with the forearm partially flexed, care being taken that the lower fragment is not drawn too far inwards.

At other times a good gutta percha, felt, or leather casing, moulded to the shoulder and arm, is very efficient. Erichsen advises a bent leather splint, the angle being well pressed into the axilla, one-half being fixed to the arm the other to the thorax.

In all these cases the surgeon should explain to the patient that some impairment of the mobility of the limb may be expected, and in impacted fractures some shortening.

Fracture of the greater tuberosity is a recognized accident, and it is usually associated with dislocation of the humerus forwards, the scapular muscles drawing the tuberosity backwards. Dr. R. Smith, in his excellent work on fractures, gives a description of two of these cases. He gives a remarkable increase in the breadth of the articulation as one of its most

striking features, the projection of the acromion and flattening of the deltoid being others. He also draws attention to the *vertical sulcus* corresponding to the bicipital groove, which is formed by the head of the bone on the inner side and the displaced tuberosity on the outer, as one of the characteristic symptoms.

Fractures of the shaft of the humerus are common. They are more readily made out and successfully treated than any other fracture. When oblique they are frequently followed by some degree of shortening, but this result is of little practical importance, as it interferes but slightly with the functions of the hand. Such fractures are as commonly the result of direct as of indirect violence, muscular action being by no means an uncommon cause. I have already mentioned an instance in which it occurred in a man during a marital embrace, and a second in which it was produced from throwing a ball. Lonsdale, Malgaigne, Hamilton, and others, have recorded similar instances.

When the fracture is transverse there is no displacement. When oblique, the tendency of the lower fragment to ride will depend upon the line of the obliquity and its position; when below the insertion of the deltoid the upper fragment will have a tendency to be drawn outwards; when above, inwards from the pectoral muscles, the lower fragment being drawn upwards and outwards by the deltoid.

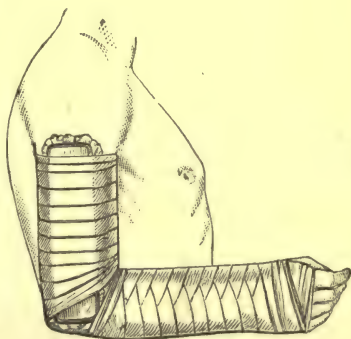
Loss of power in the arm, mobility of the bone, crepitus, local pain, and deformity, are ample symptoms to indicate the accident. An error in diagnosis ought not to occur.

TREATMENT.—The treatment of these cases is not really difficult, although, from the fact that ununited fracture is more frequently found in this bone than in any other, it would appear as if the practice was less successful. In a measure this conclusion must be regarded as a correct one, and I would explain it by the want of a due appreciation of Boyer's rule of treatment,—to keep the joints above and below the broken bone in absolute rest. In fractures of the arm the practice is too common simply to apply splints to the arm, and to allow perfect freedom to the action of the forearm, the surgeon forgetting that in moving the forearm the triceps and brachialis anticus, with the biceps, have as powerful an action upon the humerus as upon the bones of the forearm.

In the primary treatment of all fractures of the arm it is a wise and scientific practice to keep the forearm at rest, and this is best done by the application of some angular splint extending from the shoulder or axilla to the wrist, associating with it a posterior or anterior short splint reaching from the shoulder to the elbow (Fig. 417). After about two or three weeks the angular splint may be removed, and some immovable one applied, the forearm being left free.

Any splints that secure immobility of the broken bone after its ends have been coapted by manipulation must be regarded as being good, and no splints will do this effectually that allow freedom of movement of the forearm. When two lateral splints appear the more adapted to keep the bones in position, they must be angular, to include the elbow, bent at a right angle.

FIG. 417.



The incomplete or green-stick fractures of children are well treated by millboard, gutta-percha, or felt splint, after the bone has been restored to its normal position.

In putting up fractures of the arm care should be observed not to press upon the radio-spiral nerve as it winds round the bone, more particularly when the line of fracture corresponds to its position.

Fractures involving the lower end of the humerus, whether transverse above the condyles, vertical through the condyles, or both together; whether complicated with separation of the epiphysis or some displacement of the bones of the forearm, are always difficult to diagnose and to treat; and when the joint is involved, either by the fracture running into it or by displacement, there is usually some subsequent imperfection in the movement of the joint.

Fracture above the condyles, where the bone is thin and expanded, whether in the child or adult; or separation of the lower epiphysis, an accident of early life, is usually produced by some fall upon the elbow; when the line of fracture is oblique from before backwards and upwards, the action of the triceps is apt to draw the lower fragment of bone with the bones of the forearm backwards, and thus give rise to the external appearance of a dislocation of the bones of the forearm backwards; the same projection of the olecranon process and hollowness above it, the same projection of the lower end of the humerus forwards, with the pressing forwards of the artery, being present. But there is this great distinction between the fracture and dislocation, as so well expressed by Sir A. Cooper: In fracture there is "the removal of all marks of dislocation on extension, and their return as soon as extension is discontinued." Crepitus of a marked kind is felt where a fracture is present, and of a suppressed kind where a displacement of the epiphysis exists; whereas in dislocation no crepitus is present, and there is marked immobility of the bones, the bones of the forearm and the condyles of the humerus having lost their natural relative position. Malgaigne also pointed out that in fracture there will be a shortening between the acromion process and the internal condyle, whereas in dislocation there will be none. In fracture the anterior projection of the end of the humerus is *above* the fold of the elbow, and not so broad or round as in dislocation, where it is *below* it.

When the line of fracture is oblique from behind forwards the action of the biceps and brachialis anticus has a tendency to draw the forearm, with the lower fragment, upwards and forwards.

Fracture of the condyles into the joint is a grave accident, as it is so apt to be followed by some stiffness of the joint; it may be oblique in any direction, the outer or the inner condyle being fractured, or associated with a transverse fracture of the bone (Fig. 418). The existence of the fracture is to be made out by manipulation, the amount of displacement varying with the character of the injury; crepitus being made out by grasping one or other condyle and moving the broken fragment; rotation of the radius often giving rise to crepitus when the external condyle is involved, and flexing the ulna when the internal.



*Right
Humerus.*

Comminuted fracture of the condyles of the humerus.

Prep. 1112²³.

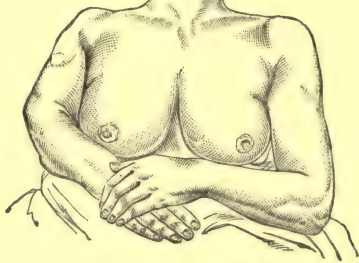
All these fractures into the elbow-joint are rapidly followed by effusion, often masking the symptoms and rendering the diagnosis difficult and uncertain; under these circumstances no diagnosis should be made until, by

rest and cold applications, the effusion has been absorbed and a full examination can be satisfactorily made; a few days are usually enough for this change to take place. In rare cases the inner condyle is simply chipped off, the joint not being implicated.

TREATMENT.—In all these cases of fractures involving the condyles of the humerus, whether into the joint or not, the fragments should be brought into position by extension upon the forearm when needed, and manipulation, and an anterior jointed splint, fixed at a right angle, applied; the upper half of the splint should pass well up the arm, and the lower half to the wrist. In some cases a posterior arm splint projecting down to the olecranon process is of use, the whole being well bound together and to the limb; the joint, as a rule, may be left exposed for external applications. Some surgeons prefer an immovable casing of gutta percha or felt from the first, and others lateral leather or pasteboard splints, but I think it preferable to leave the joint exposed.

In children the bones unite in about three weeks, and in adults after a month; consequently all splints should be removed at the end of these periods, and passive movement allowed. Hamilton, however, in his great work on fractures, believes that passive movement ought to be commenced within seven days, and perseveringly employed until the cure is accomplished. He does not admit the use of splints after this period, believing that the new material has steadied the fragments, and that the danger of displacement is but little, while the prevention of ankylosis demands early and continued motion. After fracture of the humerus, as of other bones, arrest of growth may follow; thus, I have seen in a woman an arrest of growth in the humerus to the extent of two inches, after a fracture of the shaft which had occurred when she was about eight years of age. I have recorded ("Guy's Hosp. Rep.," 1862, Fig. 419) a case in which the humerus was five inches shorter than its fellow, in a woman *æt.* 30, this shortening being accounted for by some injury to the upper part of the bone during infancy. In the first case the arrest of growth was probably due to some injury to the nutrient artery of the bone, in the second to injury to the epiphysial cartilage at the upper part of the shaft.

FIG. 419.



Arrest of growth after injury.

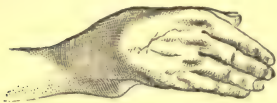
Fractures of the Bones of the Forearm.—These form about two-fifths of all fractures, half the cases consisting of fracture of the radius alone, a fourth of fracture of the ulna including olecranon process, and the remaining fourth of the two bones together; fracture of the radius and ulna together being about equal in frequency to that of the clavicle.

Fracture of the radius may take place at its head, neck, shaft, or lower end; when of the neck or shaft the fragments of bone are usually loose and yield on manipulation a distinct crepitus, the head of the bone being felt not to rotate in its position. Fractures of the lower end of the bone are, as a rule, impacted, the compact shaft of the bone being driven into the cancellated carpal extremity.

This latter accident is generally the result of a fall upon the hand, and is very common; fractures of the shaft or neck may be produced in the same way, but they are more commonly caused by direct violence.

Fractures of the lower end have always been of special interest. Colles, of Dublin, first described them in 1814 ("Edin. Med. and Surg. Jour."), and such injuries are now generally known as Colles's fracture. Dr. R. W. Smith has also done much to draw attention to its true nature in his work on fracture, where he explains the characteristic deformity by muscular action. Figs. 420-1 show the appearance of the wrist, with displace-

FIG. 420.



Fracture of lower end of radius and displacement backwards. Dorsal view. From W. Smith.

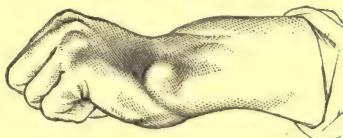
FIG. 421.



Fracture of radius and displacement backwards. Side view. From W. Smith.

ment of the broken end and hand backwards, Fig. 422 shows displacement forwards.

FIG. 422.



Fracture of radius and displacement forwards. From W. Smith.

Callender, however, more recently, in an able paper ("St. Barth. Rep.," 1865), has shown that Voillemier, Malgaigne, and Nélaton's views are the more correct, and that *impaction* rather than muscular action is the true explanation of the deformity.

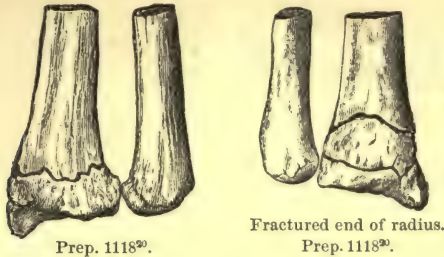
"The radius is first broken, then, by the momentary continuance of the force in the direction of the falling body, forwards and outwards, the shaft is driven into the carpal end, burying itself chiefly from the dorsal surface towards the palm, and towards the outer or the inner side. In a great number of cases this impaction so fixes the fragments that they cannot be unlocked, and the deformity is permanent." (Callender.) The thirty-six specimens of fracture of the lower end of the radius which the museums connected with the London schools of medicine contain, show clearly that the cause of each deformity is the impaction of the proximal in the distal portion of the broken bone.

The fracture is usually placed about half an inch or an inch above the wrist-joint, the lower fragments generally being rotated and displaced backwards, giving the articular surface an inclination in the same direction; the outer side of the fracture towards the styloid process being rotated more than the inner, the strong ligaments uniting this with the ulna holding the bone more in position. On this account the lower piece is often broken vertically as well, giving rise to greater deformity and to shortening of the bone on its outer border. In some cases the end of the bone is broken into fragments (Guy's Museum, 1119³²). Fig. 423 illustrates a case of fracture of both radii from a fall on the hands.

The *diagnosis* of this accident is not difficult; indeed, the aspect of the wrist may be said to be characteristic, the lower end of the radius being rotated backwards and often outwards, the hand with the carpal bones appears to be displaced backwards, a corresponding depression of the carpal

bones existing in front, with projection of the lower ends of the bones of the forearm, the amount of this deformity turning upon the amount of dis-

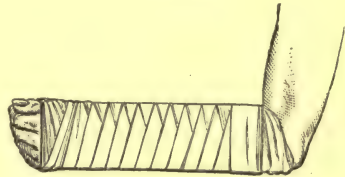
FIG. 423.



placement of the broken fragments. There will be pain in the part, increased by pressure on the seat of fracture and about the internal lateral ligament, with some projection forwards of the styloid process of the ulna; the movement of the joint will be rendered impossible. On feeble movement of the hand the head of the radius will be felt to rotate, the fracture being an impacted one; crepitus will either be absent or very indistinct, it can only be well brought out by loosening the broken bones—a very questionable proceeding, particularly in old subjects. In the young the parts may be replaced by some traction of the hand inwards and manipulation; but in the old, more particularly in old women, with whom the fracture is common, Velpeau's advice to leave the parts alone is probably the best; indeed, in a large number of cases it is impossible to loosen the impacted fragments.

TREATMENT.—In all fractures of the radius it is essential to keep the hand at rest, and as a consequence all splints should extend at any rate down to the base of the fingers. In fractures of the neck or shaft the elbow should be bent at right angles, and the hand held midway between pronation and supination; two well-padded splints extending down to the fingers being firmly fixed on by strapping, broad bands, or a roller (Fig. 424). When, as in fractures of the shaft, there is a disposition for the fragments to fall inwards, some extra pad may be employed.

FIG. 424.



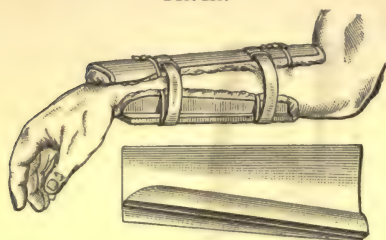
After three weeks the splints should be removed, and freedom given to the hand, movement of the muscles being encouraged; shorter splints or some immovable apparatus being substituted down to the wrist whilst union is consolidating. Lateral pressure of the bandages should always be avoided.

In fractures of the lower extremity of the radius the old-fashioned pistol-shaped splint is still in favor with some, its object being to keep the hand and wrist adducted, and thus to counteract the deformity that so commonly attends this form of fracture. Some surgeons, and more particularly the American, apply it to the palmar, and others, as Nélaton, to the dorsal aspect, with a shorter second splint.

I am no believer in its virtues, for if the fracture be an impacted one, and the fragments are not loosened, it is useless, and union has only to go on between the impacted fragments for a cure to be effected; when the fragments are loosened and the bones brought into apposition by extension

and manipulation, the pistol splint is not wanted; indeed, it is probably injurious, causing displacement of the broken bones; one well padded broad anterior splint, reaching to the fingers, with a dorsal splint, answers every purpose, the wants of the individual case determining the amount and position of the extra padding.

FIG. 425.



Gordon splint.

Dr. Gordon, of Belfast, has recently introduced a splint that has found favor. The palmar splint (Fig. 425) is hollowed out for the pronated forearm, the hand being left free; on its radial side a rounded ridge of wood is fixed, which is said to keep the fragments in position. The dorsal process is broader at its carpal end than towards the elbow, and has an overhanging lip on its radial side. The two splints are well padded, and applied as seen in Fig. 425.

The forearm should be well supported by a sling.

The wrist-joint rarely recovers its normal movement after this form of fracture, some deformity permanently remaining, of which the patient should be warned.

Fractures of the ulna are almost always the result of direct violence, the middle and lower parts of the shaft—the thinner portions—usually suffering. Fracture of the *olecranon* process is, however, a very frequent accident, from a fall or blow upon the elbow, or from a sudden action of the triceps, and a fracture of the *coronoid* process (Guy's Museum, 1119²⁵), with or without dislocation of the ulna backwards, has also been described; it is, however, very rare. In the case from which Fig. 427 was taken it existed with fracture of the head of the radius. It occurred in an old woman from a fall upon the elbow.

In fracture of the shaft there is, as a rule, little displacement, and when it exists it is of the lower fragment. On manipulation crepitus is usually present, with local pain.

In fracture of the *olecranon* there is always more or less displacement of the end of the process, and the smaller the piece the greater the displacement, the base of the process being held well in position by the fascia covering the bone and the periosteum.

TREATMENT.—In fractures of the shaft the treatment is simple, the radius acting as a splint and preventing shortening. The surgeon has consequently only to see that the broken bone is kept quiet and that the fragments are in position. This is well done by means of an anterior and posterior splint, both being well padded, the hand being fixed in a position midway between pronation and supination.

In fractures of the *coronoid* process the forearm should be kept flexed, to relax the *brachialis anticus* muscle, which is inserted into it; and in fractures of the *olecranon* nearly *straight*, to relax the *triceps*, through which the separation of the fragments take place. The splint may be strapped on or fixed by strapping, in severe cases an immovable apparatus being advisable.

In fractures of the *olecranon* some separation of the fragments very frequently remains, and when the arm is used too soon this separation increases, the power of the arm being consequently weakened. Passive movement of the arm should, however, always be permitted about five weeks after the accident, all violent efforts being condemned.

Fracture of both radius and ulna occurs about as frequently as fracture of the ulna alone, but not a quarter as commonly as fracture of the radius. *Direct* violence is the usual cause, a fall upon the hand being more commonly followed by fracture of the radius than of the two bones.

Malgaigne has recorded instances of this accident from muscular action, and recently a case has been recorded in which the same cause was followed by the same result. In infants the "*green-stick*" or "*incomplete*" fracture of both bones is not infrequent.

The fracture may be transverse, oblique, or comminuted, and the displacement of the fragments may vary vastly, according to the direction and violence of the force which produced it.

These fractures are readily made out, and are not often difficult to manage, although at times the surgeon's ingenuity is taxed to prevent deformity.

Under all circumstances the forearm should be flexed, and the hand kept in the semi-prone position. Two wide splints should be employed, coming down to the fingers, well padded and broad, the surgeon so arranging his pads as to prevent deformity and neutralize the peculiar tendency of the fracture. When the parts are bandaged too tightly the bones may be pressed together, and consolidation, as a whole, take place, with consequent loss of motion, or the two bones may be braced together by some bony isthmus (Fig. 426.) Under all circumstances the fracture should be put up with the hand supinated, the dorsal splint being first applied, and then the palmar, the forearm, as soon as the splints are fixed, being semiflexed.

When fracture of the radius and ulna takes place above the wrist-joint the symptoms may simulate those of dislocation. With care, however, such an error ought not to be made, the greater mobility of the lower end, crepitus, and local pain, being enough to forbid the error being acted upon.

Fracture of the carpal bones can only occur from direct violence, some crushing force being the usual form. It may be difficult to diagnose, for the same force that produced the fracture, to a certainty will have injured the soft parts around the bones. Happily, however, the treatment of any severe injury to the wrist ought to be such as will serve for all; for the application of an anterior splint, cold lotions, and absolute rest of the injured part, ought always to be observed in all clear as in doubtful cases, and with this a good result ought to be secured.

Fracture of the metacarpal bones is not rare; it is commonly caused by some blow when fighting, or other form of direct violence. It is rarely complicated with any displacement. In young subjects the head of the bone, or epiphysis, may be displaced. It is to be treated as are all fractures, "with brains," the pads and splints being so applied as to fulfil the wants of the individual case. In the majority a simple pad placed on the palm, with an anterior splint, may be sufficient. In one case Malgaigne's plan of placing a thick compress under the head of the bone, and a second over the dorsal projection, with two broad splints across the hand, may be called for. In another, Sir A. Cooper's, of binding the flexed fingers over a ball may fulfil the necessary requirements; but, as a rule, a simple splint and palmar pad, carefully adjusted, supplies every want and is enough, the surgeon remembering that the palmar surfaces of these metacarpal as well as phalangeal bones are concave.

Fracture of the phalanges is usually compound, although it may be

FIG. 426.



Prep. 1119³⁰.
Radius and ulna
consolidated after
fracture.

simple; it is easily diagnosed and readily treated, a simple anterior splint being all that is required; a dorsal one is rarely called for; a piece of wood will do for the purpose, but a thin piece of perforated zinc is better. Strapping is better to fix the splint with than a bandage, a coating of the compound tincture of benzoin rendering all firm and immovable.

FIG. 427.



Fracture of the coronoid process and head of radius, taken from a woman æt. 70.

In compound fracture into the elbow-joint excision is, probably, the wisest step to adopt, for recovery without operation can only take place with ankylosis after a long and tedious process of suppuration; by excision convalescence is hastened and a better arm, as a rule, given. In aged subjects amputation may be called for; in the one from which the preparation here figured (Fig. 427) was taken such a step was demanded. I have given the drawing, as it illustrates an uncommon form of accident—comminuted fracture of the head of the radius and fracture of the coronoid process; it was produced in a woman, æt. 70, from a fall on the elbow. In a case I had, not long ago, of compound comminuted fracture of an elbow that had been ankylosed from a former injury, I excised the fractured bones and gave a movable joint.

Compound fractures of the arm and forearm are to be treated upon the same principles as the simple—that is, when the injury is not sufficient to necessitate amputation or excision. The bones are to be brought into apposition and kept there by means of splints, interrupted or not, the wound being left uncovered by the splints, but covered either by lint soaked in blood or, by what is better, the compound tincture of benzoin. It may be added that the injury should, indeed, be great to necessitate amputation, some extra risk being justifiable to save the upper extremity.

FIG. 427a.



Fig. 427a represents a displacement of the lower epiphysis of the radius and dislocation of the ulna, for which amputation was demanded.

In a recent severe case of compound comminuted fracture of the humerus, caused by the passage of a rifle bullet through the bone, good success attended the immediate sealing of the wound with benzoin and the application of the splint, the man leaving the hospital in three months with a firmly united bone, although with a sinus. This sinus healed two weeks after he left, and a good sound arm was secured.

In the way of treatment of compound fracture of the humerus I have little to add to what has already been given beyond an allusion to Stromeier's triangular cushion, which commends itself to our attention as much by the eminence of its advocate as by its apparent usefulness. It has been introduced to our notice by Mr. William MacCormac. (Fig. 428.)

The cushion may be described as a right-angled isosceles triangle, four inches thick at the apex and fourteen or fifteen inches in length, which rests against the chest and supports the elbow, the forearm being bent at a right angle with the arm. The cushion gradually thins down till the base is a mere edge; one of the angles of the base is passed into the axilla, while the other rests on the chest under the wrist. The cushion is readily fastened in its place by a tape round the neck and one round the body; when this simple apparatus is applied the arm rests beautifully supported and in ex-

cellent position. Whilst lying in bed nothing beyond the ordinary dressings are required for the wound, and if the patient need to be transported from one place to another, or is fit to walk about, this can be arranged for with the utmost facility, as cushion, arm, and all, can be bound by a broad bandage to the body and thus form an immovable whole. Stromeyer considers this cushion to be "the most valuable appliance he had invented during his life."



FIG. 428.

Stromeyer's cushion (from MacCormac).

Compound Dislocation and Fracture of the Phalangeal Joints.—This subject has not been fully discussed in the previous pages, as the position and value of the joints themselves render a distinct consideration of their treatment requisite, and the slight constitutional symptoms which such injuries induce enables the surgeon to treat them with purely local consideration.

It is unnecessary at the present time to dwell upon the importance of the integrity of the hand as a whole, or to bring forward arguments to prove the necessity of saving as much as possible of the thumb and fingers. These are now acknowledged rules of practice, and yet such rules have their limit, for it must not be forgotten that ankylosis of some of these joints may prove an impediment rather than an advantage to the free use of the hand. A stiff finger to a man in one business may be most detrimental, whilst a bent one in another may be of value.

With the thumb the above rule may be considered absolute, and an attempt should invariably be made to save the joints and as much as possible of the injured parts; leaving the bone to granulate in compound fractures, being often better than its removal, for the use which may be made of the stump of a thumb, or of one fixed by ankylosis, can only be appreciated by those who have been fortunate enough to witness such instances.

With the fingers the rule will not hold so good, for it often happens that the loss of a finger will be found of less inconvenience than a stiff one. In a general point of view a stiff metacarpo-phalangeal joint is an impediment to a laboring man, although to a gentleman it may be of service, and at the same time preserve the comeliness of the part. A stiff first phalangeal joint will in some trades be most prejudicial, while under other circumstances it is of slight importance. A stiff joint between the extreme phalanges is rarely of much moment.

As a good rule of practice, the patient should be consulted by the surgeon in all these cases, and the treatment moulded to the wants of the individual case; a position that may be good for one, may be bad for another, no one position being applicable to all. It is too common at London hospitals to find men applying to have fingers removed that have been saved, but fixed at bad angles or no angles at all, the stiff finger being an impediment to the free performance of their trade, and its removal becomes a necessity.

In compound fractures and dislocations of the thumb loose fragments of bone should be removed, and joints, when injured, excised. The soft parts should be saved as much as possible, and the wound left to natural processes for repair, it being the best practice to cover in the whole with lint saturated with the compound tincture of benzoin.

To amputate a thumb for injury should be a very rare operation.

In these injuries to the fingers the same principles of practice should be adopted, although they must be modified by the wants of the individual

case. To save a finger, and then have to amputate it months after, on account of some stiffness of joint or malposition, is to waste time; when a joint has been opened, and ankylosis must be looked for after a natural recovery, the propriety of making the attempt should be discussed before the practice is decided upon.

Should the decision be in favor of saving the member, the injured parts are to be adjusted and fixed in the most favorable position for the patient by means of a splint, a piece of perforated zinc being the best, and the whole bound on with lint soaked in the benzoin tincture.

In most subjects the straight position is not the best; it is not one ever assumed by nature, with the hand at rest; it is a forced and inconvenient one. The best, in the majority of subjects, is the slightly bent—the one which the hand naturally assumes when at rest, in which the thumb and fingers can touch at their tips. In exceptional cases exceptional positions will be asked for. I not long since, when treating a laborer for some severe injury to the metacarpo-phalangeal joints of the right middle and ring fingers, in which recovery with ankylosis was a certainty, at his request fixed the fingers at a right angle, for, as he said, his sole work was to use the shovel with his right hand, and this position was the only one which would allow him to do it. This practice was followed, and he told me that he could work as well after the accident as he did before.

The best splint for fingers is a piece of perforated zinc; it is thin, and can be bent to the required curve without trouble, and readily fixed on with strapping or lint saturated in the tincture of benzoin.

CHAPTER LXXXI.

FRACTURES OF THE LOWER EXTREMITY.

Fractures of the pelvis, as of the cranium, spine, and thorax, are of importance, as the visceral contents are involved, and when no such complications exist the injury is not, comparatively, dangerous.

Fracture and dislocation of the bones commonly occur together, and may be regarded as alike in a clinical point of view.

The **anterior portion of the crest of the ilium** is not rarely broken from direct violence, and the accident is not a serious one. Rest in bed, to keep the abdominal muscles quiet, and the application of a pad with strapping when displacement is present, or a broad pelvic pad, are the ordinary surgical means required.

Fracture of the pelvic basin itself is usually the result of some crushing force, the weakest part breaking, such as the rami of the pubes—the fractured ends of which too often cause laceration of the urethra; in other cases some separation of the pubic bones at the symphysis exists, with other fractures. In a case I had under care, in a female *æt.* 30, the bones were displaced on the right side for more than one inch, a curious deformity resulting; the bone with the adductor muscles being curved out, leaving a hollow on the inner side of the thigh.

In another case, sent to me by Dr. Bennett, of Bulth, in a female child, great separation of the pelvic bones was present, the whole pelvic organs having been pressed out of the outlet of the pelvis by the crushing force: the large intestine for about a foot, uterus, bladder, &c., all were in view, the whole perineum having been ruptured.

The drawing below (Fig. 429) shows the child's condition when I saw

her fourteen months after the accident. How the child escaped with life was a mystery, the perinæum being gone, the bowels protruding, and the

FIG. 429.



Fracture of the pelvis in a child, with separation of pubes, &c.

FIG. 430.



Prep. No. 1134, Guy's Hosp. Mus. Fracture of pelvis.

bones of the pelvis being widely apart. Such a case is enough to show how great an injury the pelvis may occasionally sustain without causing death.

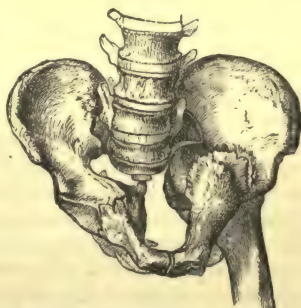
As an example of fractured pelvis, Fig. 430 may be referred to. In the museum of the College of Surgeons a specimen exists, given by Sir D. Gibb, in which recovery followed a most severe injury. The greatest care is called for in examining a patient the subject of a suspected fracture of the pelvis, and the diagnosis can generally be made from the nature of the force employed, its direction, and the complications that exist. Urethral complication is the most common in the male; it is to be treated as already described at page 536. Under all circumstances the utmost quiet is to be enforced, for if the surgeon is unable to restore the fractured bones to their normal position, he must, at any rate, do nothing to render their displacement greater, or to increase the risk of visceral injury. Where support by means of a bandage, strapping, some gutta percha or other casing, gives comfort, or seems called for, it should be applied; but, in general, absolute rest, and such treatment as the complications may require, are all that is needed.

Fracture of the Acetabulum, from the head of the femur being driven against the bone, has been recorded. Earle, in the nineteenth volume of the "Med.-Chir. Trans.," gave a case in which the pelvis was broken into its three anatomical portions. Sir A. Cooper and Travers have recorded other cases; and Moore, in the thirty-fourth volume of the same Transactions, has given one with a drawing as figured below (Fig. 431). Travers believed that acute pain on pressure upon the projecting spine of the pubes, and inability on the part of the patient to maintain the erect posture after pelvic injury, are diagnostic of *fissure of the acetabulum*. When the head is driven into the pelvis, as illustrated in the drawing, there will be deformity of the hip, inability to move the limb, with pain in the attempt, and crepitus.

A fracture of the *lip of the acetabulum* is probably present in such cases of dislocation of the hip as become displaced again after reduction; the head of the bone slipping out of its cup, having nothing to restrain it.

This accident is more frequently found associated with dislocation of the

FIG. 431.



Head of femur driven through acetabulum. "Med.-Chir. Trans.," vol. xxxiv. Travers's case.

head of the femur backwards than any other. In these cases the reduction of the dislocation is usually attended with crepitus, and followed by redilocation on the removal of the extending force. It should be treated by fixed extension, as in fracture of the thigh-bone, and some circular pelvic pressure.

Fracture of the sacrum may be clinically regarded as that of the pelvis; it is always the result of direct violence.

Fractures of the lower extremity.—From hospital statistical information these appear to be more common than those of the upper extremity; but in this there is a fallacy, for the large majority of cases of fracture of the upper extremity is treated as out-patients, and no records are kept of the cases. Mr. Lonsdale, however, tabulated all cases at the Middlesex Hospital for six years, and found that 516 examples of fracture of the lower extremity took place to 764 of the upper, proving that fractures of the upper extremity are 50 per cent. more frequent than those of the lower.

Fractures of the Femur may be divided into those of the *neck or upper end*, those of the *shaft*, and those of the *lower or condyloid end*.

Fracture of the neck or upper end existed in 44 out of 217 consecutive cases admitted into Guy's, or in one-fifth of all cases; it is more frequent in the old than in the young, probably from the impaired nutrition of the bone, the cortex in the aged being always thinner and the cancelli larger. I have, however, seen it in a patient æt. 27. Stanley and Hamilton have recorded examples at even an earlier age, and in the Guy's Museum, Prep. 1184, there is a specimen taken from a child æt. 9.

In a clinical point of view the best division of fractures of the upper part of the femur seems to be into the *impacted* and *unimpacted fractures*; the latter differing from the former only in the fact that the impaction has ceased to exist either from some dislodgment of the impacted fragments or from a comminution of the bone. Sir A. Cooper saw this, although he did not quite recognize its importance, when, in describing fractures of the upper part of the thigh-bone, he wrote, "The fracture is placed at the root of the neck of the thigh-bone, the trochanter is split, and the neck of the bone is received into its cleft. It frequently happens in this injury that the fracture of the neck of the thigh-bone is complicated with an injury of the trochanters, major and minor; the neck of the thigh-bone is forced at times into the cancelli of the major trochanter."

To Professor R. W. Smith, of Dublin, the thanks of the profession are unquestionably due for having given a prominence to this class of cases, and in his valuable work on fractures in the vicinity of joints, published in 1850, will be found nearly all that is known upon the subject.

The opportunities I have had of witnessing these cases in the living as well as of examining morbid preparations enable me cordially to agree with Professor Smith, "that all extra-capsular fractures are, in the first instance, also impacted fractures." I believe, moreover, that many intra-capsular fractures and all mixed forms are primarily of a like kind. I agree also with Dr. Smith, "that it depends principally upon the violence with which the injury has been inflicted whether the neck of the bone shall remain implanted between the trochanters, or whether these processes shall be so completely separated from the shaft of the femur as to allow of the escape of the cervix from the cavity which it had formed in the reticular tissue of the lower fragment. If the force has not been very great the neck of the femur remains wedged in between the trochanters, and one or both of these processes are split off from the shaft; and if the fibrous structures around the neck of the bone and trochanters have not been injured, these broken portions of the trochanters are still held firmly in their places,

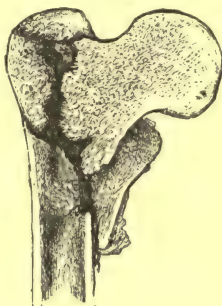
and the impacted cervix does not become loosened (Fig. 432); but if the force has been considerable, the impulse prolonged, the bone in a state of senile atrophy, or if, as frequently happens, the patient in endeavoring to rise falls a second time, then, under these circumstances, the trochanters are not only broken from the shaft of the femur, but are so far displaced and separated from their connection with the soft parts that the cavity or socket, as it were, into which the superior fragment has been received is destroyed; the impacted cervix thus set free no longer opposes the ascent of the inferior fragment, and the case then presents the characters of the ordinary extra-capsular fracture with great shortening of the limb" (Fig. 433). In fact, the ordinary extra- or intra-capsular fracture of the neck of the thigh-bone is as an impacted fracture, the impacted bones being loosened in some

FIG. 432.



Impacted fracture of the neck of the thigh-bone, from the museum of my father, the late Mr. T. E. Bryant. Prep. Guy's Mus., 1187⁴⁵.

FIG. 433.



Comminuted fracture of the upper part of the thigh-bone, from the neck being driven into the shaft. Prep. 1194, Guy's Mus.

cases by a second fall, in others by excess of violence received in the original accident, and in too many instances by the surgeon in his anxiety to make out the presence of a fracture by the detection of crepitus. Indeed, this seeking for crepitus in all cases of fracture is a practice fraught with danger; in fractures of the neck of the thigh-bone it is not only unnecessary, but unjustifiable; it is unnecessary because the diagnosis of the case can be made out without the help of such a symptom; it is unjustifiable because in every case of impacted fracture the attempt to find it is often attended with irreparable mischief.

The *diagnosis* of an impacted fracture is, therefore, a point of considerable importance, for it is not to be disputed that the recovery or lameness of many a patient rests entirely upon a correct appreciation of the value of such a combination of symptoms as usually exists in this variety of fracture, and that too in a very critical period of the case; for should an error in diagnosis be made, and the case—as one of impacted fracture—be overlooked, violent manipulative efforts will probably be made to reduce the supposed dislocation or to set the supposed fracture, or what is equally probable, to decide the question between the presence of the two by the detection or non-detection of crepitus, when, as a consequence, the impacted bones will to a certainty be loosened, if not dislocated, and the case changed from being one in which the bones are placed favorably for union and for recovery, into another in which a very different condition of circumstances has to be encountered, and a less favorable prognosis given.

Happily, however, the diagnosis of these cases is not difficult, and the symptoms that indicate the presence of an impacted or non-impacted frac-

ture are fairly characteristic. They may be given as follows: A blow or *fall upon the trochanter*, followed by *loss of power* in the limb, more or less complete, attended with *shortening* for about an inch, which extension will not rectify, and a *fixed, everted, or straight* position of the foot. The great trochanter will be found nearer the median line of the body, and also nearer the anterior superior spinous process of the crest of the ilium, than on the sound side; the head of the bone will be made to rotate in the acetabulum, and the trochanter will rotate with it. There will be no crepitus, or it will be very indistinct. Local pain will always be felt on pressure behind the trochanter, and local thickening within a few days of the accident. In exceptional instances the foot may be inverted, and at times the patient, when on the couch, will be able to rotate the limb slightly or partially flex it.

Now these symptoms, taken as a whole, may be looked upon as pathognomonic of an impacted fracture; for, although there are other injuries to the hip-joint which may give rise separately to many of the symptoms detailed, there are none in which all or most are found combined. There is no injury to the hip-joint in which the head of the femur rests and can be made to rotate in the acetabulum, and in which immediate shortening is ever found, with the exception of a fracture; and there is no form of fracture that occurs under like circumstances, with the exception of the impacted, that is not accompanied by crepitus that can be readily detected, with complete eversion of the foot, marked shortening, and loss of power over the limb.

These points are well brought out in a paper in the "Med. Times" of 1869, in which I gave a careful analysis of fourteen cases.

When sudden increase in the amount of shortening takes place after an injury to the hip some days after the accident, it generally means the separation of the impacted bones and the drawing up of the lower fragment. When some gradual shortening follows, it signifies the absorption of the injured neck of bone.

The eversion of the limb, as found in the non-impacted fracture, is due to the simple weight of the broken limb, aided by the action of the powerful



FIG. 434.

Prep. 1187⁵⁰, Guy's Mus. Intra-capsular fracture of the neck of femur. Case of the late Mr. T. E. Bryant.

external rotator muscles, and possibly of the adductors. The slight eversion, straight, or inverted position of the limb in the impacted fracture is determined by chance, for in such the foot will be fixed by the impaction in the position in which it existed at the time of the accident.

When the fracture takes place near the head of the bone it is called *intra-capsular* (Fig. 434), when near the trochanters *extra-capsular* (Figs. 432-3). Both forms may be *impacted*, and in Fig. 407 both are seen together. In the *intra-capsular* non-impacted fracture there is usually less shortening than in the *extra-capsular*; this symptom depending in both of these cases upon the amount of separation of the fibrous covering of the broken bone. In the former also crepitus is less distinct, as are the external evidences of fracture. In both these forms the shortening will be made to disappear by extension, whilst in the impacted, in any of its forms, no such effect will be produced, that is, by ordinary force.

It can only be by carelessness that a contused hip can be mistaken for a fractured one, impacted or otherwise. I have known, however, this error to be committed.

"The practical importance of readily identifying this fracture," writes Bigelow in his valuable monograph on the hip, "lies in the fact that its

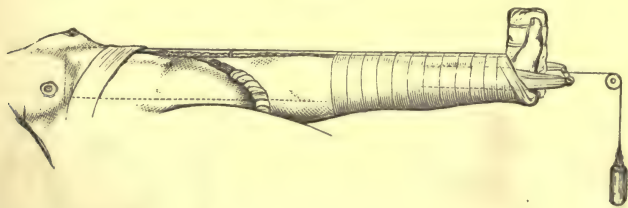
progress, as regards both time and good union, is in general more favorable than that of the unimpacted fractures; that though it is a comparatively common and disabling accident, it may exhibit little deformity; and, lastly, that the object of extension in its treatment is to steady the limb, and not to draw it down." He gives as pathognomonic signs, disability, pain and tenderness resulting from local violence, especially when applied laterally, as in a fall upon the hip; shortening and eversion, however slight; absence of crepitus; and, lastly, the rotation of the trochanter through an arc of a circle of which the head of the bone is the centre, instead of upon the axis of the shaft, as in detached fracture of the neck.

TREATMENT.—Every case of fracture of the neck of the femur, impacted or non-impacted, intra- or extra-capsular, in the young, middle-aged, or old, is to be treated as if repair and union are sure to take place if the parts are kept at rest and in apposition; and in the large proportion of cases the hopes of the surgeon will not be disappointed. In the impacted fractures of every form union is to be looked for if the broken fragments are left alone and not loosened by a careless or too curious manipulation. In the purely intra-capsular fracture union may take place, osseous union resulting in many cases, fibrous union in more, no union in a few; and when the latter result follows treatment it is too often because the fractured bones are not kept sufficiently closely at rest and in apposition. In the exceptional cases of non-union it is from a total separation of the head of the bone from its attachments, and from the feeble power or age of the patient, the broken fragment receiving too little nourishment to allow of sufficient reparative material to be poured out. Under these circumstances the head of the femur is found loose in the acetabulum, its broken surface being smoothed into a cup-shaped cavity, in which the rounded end of the broken neck of the femur plays as in a false joint.

In the impacted fractures the limb is simply to be kept at rest, and this end is well secured by means of a long splint.

In the non-impacted, extension is to be more thoroughly employed; the limb being brought down to a level with its fellow, and maintained there by means of the long side splint and the use of weights. (Fig. 435.)

FIG. 435.



Sir A. Cooper's plan of placing the patient on a double inclined plane has few advantages when union is to be looked for, and even the broad well-padded belt which he applied round the pelvis in order to keep the broken fragments closely together cannot be recommended; still, where the long splint cannot be worn the inclined plane may be substituted.

In the impacted fracture no perineal pad is wanted, as no extension is required; in the non-impacted it is of essential importance where weights are not used, but care must be observed that it is well applied and well padded, particularly in aged subjects; an india-rubber perineal band is better than a leather one.

When the necessary confinement to the supine position cannot be tolerated and bed-sores appear, it may be necessary to give up the long splint, and under these circumstances it is a wise plan to fix the hip, pelvis, and thigh, in some strong immovable casing, similar to that employed in hip disease (Fig. 364), the limb being kept extended by means of weights attached to the foot during the setting of the material. The casing may be of leather, felt, perforated zinc, or flannel, with starch, or gum and chalk.

To let the patient get up without any apparatus is not only to give up all hope of a cure by union, but to add to the local irritation; the broken fragments grating against one another, and irritating the soft parts around, often cause severe local and constitutional disturbance; under all circumstances immobility of the broken bone is to be insured, but whether by splints applied outside the limb or by some immovable casing is, probably, immaterial.

Fractures through the trochanter occasionally occur; Sir A. Cooper describes them as oblique fractures not implicating the neck of the bone; they are to be made out by the mobility of the lower portion of the bone whilst the upper part is fixed, and all the other signs of fracture, as crepitus, &c. They are to be treated like fractures of the neck.

Separation of the epiphysis of the head of the bone has been described. South has recorded such cases in his "Chelius's Surgery," and Post, of New York, in the "New York Journal," vol. iii, but no preparation exists to demonstrate the fact. It is, doubtless, possible in the young, and would be known by some such symptoms as those of fracture of the neck, crepitus being exchanged for what South calls a "distinct dummy sensation" on rotating and extending the limb. As a consequence of disease it has been already described.

Fracture of the epiphysis of the trochanter major is a more definite accident, and has doubtless occurred. Sir A. Cooper recorded such a case, which Mr. Aston Key had observed, and the diagnosis was verified after death. In that case the broken fragment, however, was not displaced; it was held in position by means of its fibrous and tendinous coverings; it was the result of direct local violence; abduction of the limb caused great pain, but all other movements were allowed; the preparation exists in the Guy's Museum, 1195, and is figured below (Fig. 436). A like case occurred recently in Mr. Poland's practice at Guy's, which through his kindness I saw; it is figured below; it occurred in a boy æt. 12, from a

FIG. 436.



Mr. Aston Key's case.
Prep. 1195, Guy's Mus.

FIG. 437.



Mr. Poland's case.

direct blow; it was characterized by a projection and thickening of the trochanter (Fig. 437).

Interstitial absorption of the neck of the bone is sometimes met with after fracture, and it is said to take place at times after a contusion without any

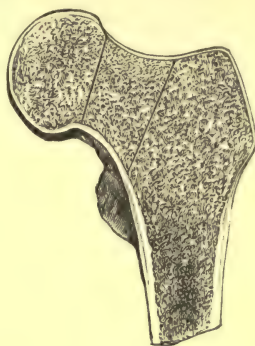
fracture. In Fig. 438 the former fact is well illustrated, the neck of the bone having almost entirely disappeared; a drawing of the section of the opposite thigh, from the same subject, is given (Fig. 439) to show the loss.

FIG. 438.



Absorption of the neck of the femur
after fracture.

FIG. 439.



Femur of the opposite side, showing
the amount of bone absorbed.

In the rheumatic osteo-arthritis these same conditions also exist; how far they may otherwise occur is an open question. My own feelings tend towards the idea that in all such cases some fracture existed, but at the same time it is difficult to prove the truth of such an opinion. The question requires further elucidation.

Fracture of the Shaft of the Femur.—This may take place in any part, but it is more common in the centre than anywhere else. Indirect violence is the more frequent cause; as a result of direct force it is comparatively rare; muscular action is an occasional cause. I have seen it from the swinging of the limb over the side of a cart in the act of descending, and in an epileptic patient from the spasm of the muscles, with the patient in bed.

The fracture may be *transverse*, *oblique* in any direction, *dentated* or *comminuted*, the nature of the force and its direction determining these points; a sharp blow is likely to be followed by a transverse fracture; a crushing force by a comminuted one; an indirect fracture will be probably oblique, according to the natural bend in the lower part of the limb. In the middle of the bone a lateral obliquity is the most common, in the lower third an obliquity from behind forwards. Fractures may also be double in the same bone or compound.

The displacement that takes place turns much upon the line of the obliquity and the position of the fracture. In fracture below the lesser trochanter the upper fragment is prone to be drawn forwards by the action of the psoas and iliacus muscles, and outwards by the external rotators. In fracture above the condyles the lower fragment is apt to be drawn backwards by the unantagonized action of the gastrocnemii. In fracture of the centre of the shaft the deformity turns upon the line of obliquity. Rotation outwards of the lower fragment is found in nearly every case.

There is usually no difficulty in diagnosing a fracture of the shaft—a fall or injury, followed by loss of power in the limb; shortening, which extension can rectify; deformity, probably angular; extra mobility of the lower part of the injured limb; crepitus; and probably the projection of

one end of a fragment, with eversion of the foot, being amply sufficient to establish the case. When the fracture is transverse the shortening will rarely be marked, when it is oblique the direction of the angular deformity often indicates the line of the obliquity.

In young children, where the fracture is incomplete, shortening with bowing of the limb after an accident, and an indistinct sensation of yielding on manipulation, with or without a peculiar crackling sensation, indicate the nature of the accident.

TREATMENT.—The fragments having been carefully adjusted by means of extension and gentle manipulation, the mechanical treatment of these fractures is comprehended in the maintenance of extension by means of some applied force and the complete rest of the coapted bones; some gentle compression of the affected part being sometimes of use. To assist the surgeon towards these ends some anæsthetic may be used if the pain is severe and it is impossible by other means to keep the patient at rest, for any spasmodic action of the muscles will interfere with the surgeon's aims.

The means adopted for these ends vary considerably, according to the fancy of the surgeon and fashion of the school.

Thus, in some hospitals, and where the Scotch influence is great, Liston's long splint is the usual one employed. The splint should extend well up into the axilla, and several inches below the foot (Fig. 435, without foot-piece). It should be well padded, and supplied with a soft perineal band, such as a leather strap, or a piece of india-rubber tubing. The ankle and instep should be well protected from pressure by cotton-wool, and the retaining bandage should be applied with equal pressure.

At Guy's, where the long splint is very generally employed, Desault's splint, with a foot-piece (Fig. 435), and the addition of a cross-bar for steadiness, is more generally preferred. The splint may be of wood or of metal, and so made with a slide to adjust to different patients.

In fractures of the upper third, where the upper fragment is apt to tilt forwards and be rotated outwards, the double inclined plane is of great value; it should only, however, be employed when the long splint fails to fulfil the objects the surgeon has in view. It is daily dropping out of favor.

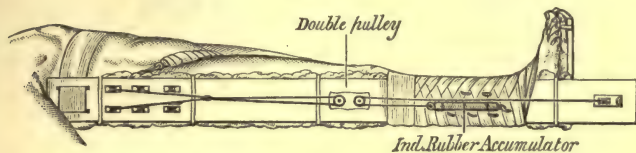
Gurdon Busk's method of applying extension to the limb by means of weights has found great favor of late years, and it is doubtless a very good and simple one, the counter-extending force being applied by means of a perineal band of india-rubber tubing fastened to the head of the bedstead, the limb being also steadied by means of long sandbags applied laterally, or short thigh splints. This plan has, however, the disadvantage of not preserving sufficient immobility of the broken bones, and ought, therefore, only to be employed in conjunction with the long splint.

A better splint than any I believe has lately been suggested by Mr. Cripps, the extension and counter-extension being kept up by one force and carefully regulated. I have used it with great advantage, and think very highly of it. The perineal pad, however, must be a thick and yet a soft one. The whole thing is figured below. (Fig. 440.)

When the fracture is compound an interrupted splint may be employed. In addition to the long splint, short additional splints are often of great value, applied in front, within, or behind the thigh, as the want of the individual case may suggest, to insure greater steadiness of the broken bone. In no case should the seat of fracture be covered in. The bandage should stop below, and if necessary recommence above. To prevent the bandage slipping after it has been applied it is a good plan to give it one coating of paste or glue.

Many modifications of these means might be mentioned. Thus, Paget has very generally employed Busk's long splint, in which a joint exists opposite the hip, this enabling the patient, after union has taken place, to sit up without affecting the thigh-bone.

FIG. 440.



Mr. Cripps's splint.

Mr. De Morgan, of the Middlesex, applies the extension to the fractured limb by means of a force carried from the foot through a pedal cross-bar to a long splint applied to the opposite one. It is ingenious, but not so good as the other plans already described. Sir W. Fergusson at times applies his counter-extension from a strong stay of jean, carefully fitted to the upper third of the opposite thigh, from which a band extends back and front to the upper end of the splint, thus doing away with the perineal pad.

During the application of the long splint careful traction should be maintained on the injured limb by a competent assistant. When muscular spasm is severe some surgeons have advised temporary pressure on the femoral artery in the groin. It is said to stop the spasm in all cases, and in those in which I have tried it, it answered well.

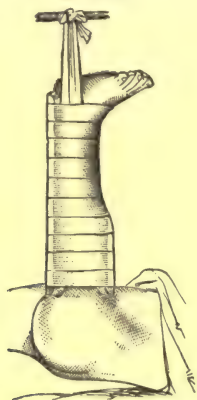
In infants and children under three years of age fractures of the thigh are treated with difficulty, for if any immovable apparatus is applied it is constantly dirtied from urine, fæces, &c., and requires to be changed; in this way the good that would otherwise be experienced is neutralized; on this account Paget and Callender have treated, within the last few years, many cases of fracture of the thigh in children negatively, without splints, all apparatus being dispensed with, "the child being laid on a firm bed, with the broken limb, after setting it, bent at the hip and knee and laid on its outer side." ("St. Barth. Hosp. Rep.," 1867.) I cannot recommend this practice, although it cannot be positively bad having regard to the gentlemen who have adopted it, but I would cordially advise instead that the lower limb of the child be flexed at a right angle with the pelvis, fixed by some light splint and hoisted upwards to some cradle, hook, or bar, above the bed (Fig. 441); by these means the weight of the body acts as a constant counter-extending force, the child can be well looked to for purposes of cleanliness, and a good result may be expected. At Guy's we have had excellent results by this practice.

Splints of gutta percha, felt, or leather, may be used, with the weights when they can be applied, some immovable apparatus being adjusted after the second week; indeed, in some cases this immovable apparatus may be applied at once, care being taken that the limb is kept well extended during its application and setting; the Bavarian flannel splint is the best (Fig. 408).

In adults also, after the fourth week, this same immovable apparatus may be employed with advantage, the patient gaining greater freedom. Some surgeons think so well of this plan as to advise its use in fracture of the thigh from the very first. Erichsen, its ablest advocate, says ("Science and Art of Surgery," p. 255) "The starched bandage may be employed in most cases. The limb should be evenly and thickly enveloped in a layer

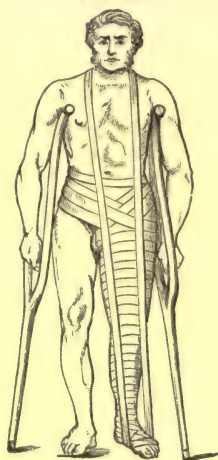
of cotton wadding; a long piece of strong pasteboard about four inches wide soaked in starch must next be applied to the posterior part of the limb from the nates to the heel. If the patient be very muscular and the thigh

FIG. 441.



Fracture of the femur in a child treated by vertical extension.

FIG. 442.



From Erichsen.

large, this must be strengthened, especially at its upper part, by having slips of bandage pasted upon it; two narrower strips of pasteboard are now placed one along each side of the limb, from the hip to the ankle, and another shorter piece on the forepart of the thigh. A double layer of starched bandage should now be applied over the whole with a strong and well-starched spica (Fig. 442); it should be cut up and trimmed on the second or third day and then reapplied. With such an apparatus Erichsen has treated many fractured thighs, both in adults and children, without confinement to bed for more than three or four days, and without the slightest shortening or deformity being left. The points to be especially attended to are that the back splint be very strong, at the upper part especially, and that the spica be well and firmly applied, so that the hip and the whole of the pelvis be immovably fixed."

Fractures of the condyles necessarily involve the joint, and these may be transverse, oblique or vertical. (Fig. 443.) In subjects under 21 the lower epiphysis may be separated from the shaft, thus simulating a transverse fracture (Fig. 444).

These cases are serious on account of the joint complication, for some stiffness of the joint generally follows, but not always; this result depends upon the amount of inflammatory action that takes place after the injury. When the head of the tibia is fractured into the joint the same observations are applicable. In these cases the posterior splint, as suggested by MacIntyre (Fig. 454), is, probably, the best, the knee being slightly flexed. When joint complication exists the application of ice or, probably, some leeches may be required.

In exceptional instances the upper fragment of bone is driven into the lower, thus giving rise to an impacted fracture; these cases, as other impacted fractures, generally do well by simple rest.

In all these cases involving joints passive motion should be allowed at the end of five or six weeks.

Nathan Smith, of New York, advocates the use of an anterior splint composed of a single piece of iron wire of the thickness of a No. 10 catheter, which is carefully bent to the inequalities of the limb and fastened to it by

FIG. 443.



Prep. 1200, Guy's Mus.
Fracture of the condyles.

FIG. 444.



Prep. 1210^b, Guy's Mus.
Separation of the epiphysis.

means of strapping and bandages, the limb being subsequently suspended to the ceiling by a cord connected with the wire above and below the knee, extension being made through this cord, and the counter-extension by so raising the foot of the bed as to tilt the body towards its head (Fig. 455).

In Fractures of the lower third above the Condyles, where the gastrocnemii muscles tend to draw the lower fragment backwards into the popliteal space, some surgeons prefer the use of the inclined plane, and where the bones cannot be otherwise kept in apposition it is, probably, a sound practice. But what I believe will turn out to be a better one is the division of the tendo Achillis and the use of the long splint; this operation paralyzes the gastrocnemii, and thus allows the surgeon to bring the bones into a good position and to deal with them as an ordinary fracture. I have taught this for the last ten years, but have had only one opportunity of testing its value.

Compound Fractures of the Thigh.—These are desperate accidents; they occur in the proportion of one case to every six or seven cases of fracture of the femur, and when they occur half the patients die. They should be treated on conservative principles where possible; that is, amputation should only be performed when the soft parts, with the vessels and nerves, are so injured as to forbid any reasonable hope being entertained of recovery, and when, in young subjects, any doubt upon the necessity of amputation exists the surgeon had better decide upon trying to save the limb; in the old an opposite practice should be adopted. Amputation of the thigh for such an accident is most fatal, two out of three cases dying. In young subjects especially conservative practice should have full scope.

Army surgeons, however, advise the propriety of practicing conservatism for gunshot fractures in the upper third of the thigh, and amputation for all fractures of the middle and lower thirds; the nature of gunshot injuries to those parts precludes all hope of a natural recovery; indeed, they only advise a conservative treatment in fracture of the upper part of the femur, on account of the excessive mortality of a high amputation: all modern army surgeons—English, French, and German—agree upon this point, and indorse Dupuytren's, Hennen's, Larrey's, and Guthrie's opinion, that in gunshot wounds of the thigh, "in rejecting amputation we lose more lives

than we save limbs," and "that in the exceptional cases which result in consolidation the condition of the limb is not encouraging."

When amputation is not at once called for, the wound should be thoroughly cleansed; all foreign bodies should be removed, with broken fragments of bone, it being important to take these away at once; the projecting portions of bone should be excised, bleeding arrested, and the wound sealed with blood, compound tincture of benzoin, or treated antiseptically; a splint should be applied at once, moderate extension employed, and the case treated on general principles.

Fractures of the Patella.—These are usually transverse, a sudden action of the quadriceps femoris under a violent effort to prevent the body falling backwards being the common cause, the knee being at the time partially bent. Such fractures are mostly met with in the centre of the bone, though they may be above or below it. "If the fracture is very low down probably the knee was but little bent, and thus the greater part of the bone still rested on the condyles." (Hutchinson, "Med.-Chir. Trans.," 1869.) In some cases both patellæ are broken, together or consecutively; in rarer instances the same patella may be broken more than once. I have such a case in a man now under care, in which one patella had been broken twice and the other three times; and in the Guy's Museum there is a preparation (Fig. 445) from my father's museum, in which the bone had been broken

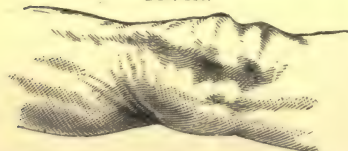
FIG. 445.

Prep 1212²⁰. Multiple fracture of patella.

transversely into four fragments, probably from different injuries or from some direct force, each fragment having a ligamentous union.

These transverse fractures are at times, although rarely, the result of direct violence. The French and American surgeons believe them to be so very frequently. Direct violence to the patella is more commonly, however, followed by what is called a starred or vertical fracture than a transverse, and in these cases there is rarely much separation of the fragments; in the transverse the separation is sometimes very great, this fact depending upon the amount of muscular action at the time of fracture. This separation is greatly increased by the effusion that is so apt to take place into the knee-joint. It is increased by flexing the leg, both before union has taken place and for many months subsequently, and from a yielding of the ligamentous union. This separation is very frequently an inch, but often more. Sir A. Cooper records a case in which five inches existed. In Fig. 446 the separation is well shown.

FIG. 446.



Fracture of the patella. Separation of fragments.

The *diagnosis* of the transverse fracture is rarely difficult, the nature of the violence, the sudden loss of power of the limb, the distinct separation of the fragments, and the bulging of the synovial sac between the divided portions of bone, being characteristic. In the *starred* fracture the different pieces of bone may be made out. In the *vertical* the diagnosis may be more difficult; it can be only made out by manipulation. In exceptional cases, where either the ligamentum patellæ or the tendon of the extensors above the patella is broken, some difficulty may be felt, but such accidents are very rare. When

the transverse fracture is little more than a fissure, no separation will be found, the amount of separation being determined by the extent of laceration of the fibrous and tendinous coverings of the bone. When the laceration is partial and the separation slight, there is a better hope of a bony or close union than when the laceration is complete and the separation great; for it should be known that union by bone may take place, although probably but seldom; that union by strong ligament, with about half an inch to an inch of separation, is more common; but that non-union is not rare. William Adams, in the "Path. Trans.," vol. xiii, tells us that out of thirty-one specimens he examined, fifteen were examples of ununited fracture, twelve of true ligamentous union, and four were doubtful. In the ununited the separation was very great; in the ligamentous it was rarely beyond an inch and a half. In the ununited the separated fragments were only connected with each other by a single layer of fibrous tissue.

That bony union takes place is now generally recognized. In Prep. 12117^s, Guy's Museum, taken from my father's museum, the fact is well exemplified. A vertical section of the bone is given in Fig. 447; the specimen has been fully described, with remarks, by the late Mr. W. King, in the "Guy's Hosp. Rep.," series i, vol. vi.

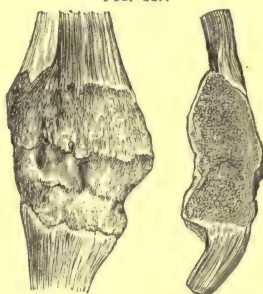
In the starred or vertical fractures osseous union is generally secured, these cases being rarely attended with complete laceration of the periosteal or fibrous covering of the bone.

TREATMENT.—In all cases of fractured patella, of whatever form, a long well-padded posterior splint, extending from the tuberosity of the ischium to the foot, with a foot-piece, should at once be adjusted, the knee-joint being left uncovered by the bandage. To the knee-joint a bag of ice or cold lotion should be applied, for as a direct consequence of the accident blood is very apt to be effused, and as a secondary effect synovial inflammation with effusion is almost sure to ensue.

It has generally been the custom to raise the heel, with a view of destroying the action of the extensor muscles, but it is now more generally believed that these muscles are already paralyzed by the fracture, and that no good is derived from such a measure; as a consequence the horizontal position of the limb is generally employed, the body being raised. At the same time the fragments should be brought together as much as possible by the fingers of the surgeon. Whether they should be retained by any apparatus is a moot point; to do so before the joint itself has recovered from the effects of the injury, whilst blood exists to any extent, or the synovial capsule is distended with inflammatory effusion, is not wise; for any attempt to draw the bones together can only result in tilting forward the surfaces that are required to be brought into apposition with no good effect.

For a few days, therefore, till all inflammatory action has subsided, the surgeon should rest satisfied by simply pressing the parts together with his fingers, and when this result has been secured the two portions may be drawn together by means of strips of plaster diagonally applied, or of india-rubber bands, covered with wash leather, attached to hooks which have been inserted at intervals of an inch on either side of the splint (Fig. 448, next page).

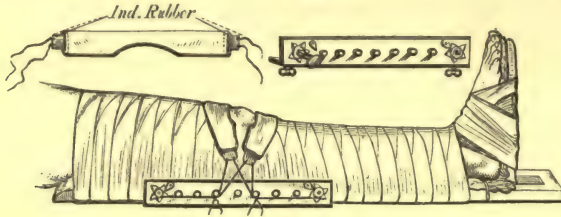
FIG. 447.



Anterior surface. Vertical section.
Fracture of patella united by bone.

Malgaigne's hooks, which are composed of four claws drawn together by a screw, are much employed, and are, doubtless, effectual, but from the fact that they penetrate the soft parts and painfully and forcibly draw the broken fragments together they are objectionable.

FIG. 448.



Dunnage's splint.

As soon as all inflammatory action of the joint has subsided, and the bones are fairly in position, some apparatus, such as the immovable flannel Bavarian splint, may be applied, the patella being left exposed or not, as the surgeon may think fit. When the bone is bandaged over, care must be taken not to press upon it, for I have known secondary suppuration to take place, with necrosis, and joint complication of a serious nature thus ensue. Erichsen uses the starch bandage as a rule in these cases, and speaks highly of it. He fixes on at first a pad above the fractured bone, with a figure-of-8 bandage. Whatever apparatus is employed it should be kept on for five or six weeks at least, and after that it may be removed, some light leather or felt casing being substituted. To allow the patient to flex the limb under three months is a hazardous proceeding, for the uniting ligament is sure to be stretched and elongated, and the limb weakened. A good leather knee-cap should be worn permanently after this accident.

It must be added, however, that even with great separation of the fragments a very useful limb is, as a rule, secured.

Compound Fractures of the Patella.—These are grave accidents, one fourth of the cases dying; when extensive they demand amputation. In healthy subjects, or in three-fourths of the cases, a good recovery may be secured. Poland, in an able paper read before the Med. Chir. Society, 1870, gave an analysis of 85 such cases, and concluded by advising that in all cases we should attempt to save the limb, and adopt the ordinary treatment as for simple fractures of the patella, whether comminuted or otherwise. The wound should be accurately closed by sutures; strapping and relays of ice should be constantly used. When suppuration sets in we must not hesitate to make free incisions into the joint; amputation is only to be resorted to when the powers of the patient fail to repair the injured joint. Detached fragments of bone had better be removed at once.

Out of the 85 cases there were 20 deaths, and 65 recoveries; in 31 with more or less complete ankylosis, in 20 with movement, 4 were resected and 5 amputated. The joint suppurated in 43 out of the 65 cases of recovery, and in all the fatal cases.

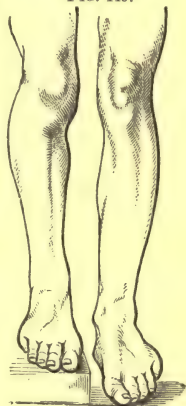
Fractures of the Leg.—These are about twice as frequent as those of the thigh. At Guy's 1090 cases were admitted in six years, against 541 of the thigh, and of these 202, or one-fifth, were compound; of the simple cases not one per cent. died from all causes; of the compound, 27 per cent. died.

Both bones are, as a rule, fractured; the fibula alone is broken, in about one case in six, and the tibia in about one in seven; Lonsdale's statistics indicate these points. These fractures are more commonly met with in adult than in child life.

In fractures of both bones those of the upper half are usually the result of direct violence; fractures of the lower half of indirect, such as the twisting of the foot or leg from a fall or jump.

In fractures of the tibia alone the line of fracture is frequently transverse, and from this cause there is sometimes difficulty in making the diagnosis; the nearer the fracture is to the knee the more transverse the line. These fractures are mostly from direct violence. They may so unite as to leave no external trace of injury; indeed, they may be attended with so little displacement that the line of the bone is never broken, and so little deformity that after union has taken place no external evidences of injury are to be made out. I have seen more than one patient walk upon the fractured limb directly after the accident, and in one case the man went up a whole flight of stairs to his ward with but a slight limp. In a medico-legal point of view these facts are important. When the shaft has been separated at its upper epiphysis some arrest of growth may take place; such a result is illustrated in Fig. 449.

FIG. 449.



Arrest of growth in shaft of right tibia (1 inch), with bowing of fibula, following injury to upper epiphysis two years before, in child *et. 8.*

Fracture of the fibula alone is more common than that of the tibia, particularly in its lower third. In the upper two-thirds the fracture is usually caused by direct violence; in the lower third by indirect, such as a lateral twist of the foot; when with it the foot is displaced *outwards*, its outer edge being raised, the accident is known as "Pott's fracture" (Fig. 347). As often as not it is associated with a forcible eversion of the foot. In this fracture, with pedal inversion, the extremity of the tibia is mostly broken off. In fracture with eversion, or Pott's fracture, the external lateral ligament remains entire, the force being concentrated against the fibula from two to three inches above the malleolus. Displacement of the foot, however, is not necessarily an attendant upon the fracture; it seems to be the result of some continuation of the primary fracturing force or of some additional force, such as that of an attempt to walk. In the indirect fracture the line of fracture is probably oblique, the obliquity being determined by the direction of the force.

Diagnosis.—In fracture of either of the leg-bones alone, the diagnosis may be somewhat difficult, and more particularly when no displacement is present. Crepitus may at times be made out by some forcible attempt to move or bend the lower fragments by some sudden inversion or eversion of the foot, but the surgeon should be careful in doing this not to do harm; local pain, caused by local pressure with the thumb over the seat of fracture, is a valuable help to diagnosis in these as in all other kinds of fracture.

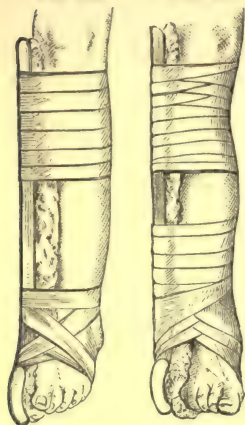
Protracted or repeated examinations of the injured limb are always to be avoided, for they only add to the mischief.

TREATMENT.—In fractures of either of these bones a natural splint is always found in the sound bone, consequently any shortening or deformity rarely follows the accident. What the surgeon has to do is simply to apply some splint to the inside of the leg when the fibula is broken (Fig. 450),

and to the outside when the tibia (Fig. 451), both splints having a foot-piece to insure rest to the broken bone and to the muscles that move the foot. In fractures of the lower third of the fibula the foot may be drawn inwards, the bandage being applied from without inwards, but in many instances nothing more is called for than absolute rest. In other cases a thick pad is often of use opposite the seat of fracture. In no case should the bandage cover the fracture.

FIG. 450.

FIG. 451.



After the lapse of a few days, or at most a week, when all swelling, with other evidence of local injury has subsided, the limb may with advantage be put up in some immovable apparatus.

In cases of Pott's fracture, or dislocation of the foot outwards with fractured fibula, Pott used to place the patient on the affected side, with the injured limb flexed, fixing the leg upon some outside splint, an inner splint being likewise very usually applied. A better plan is, however, found in the posterior and two lateral splints, with a swing, as seen in Fig. 453, this mode of swinging the limb being a very good substitute for Salter's swing (Fig. 454).

Fractures of both bones occur in every variety; the most common is a transverse one, about three inches above the ankle, but every form of oblique, dentated, comminuted, and vertical fracture is met with (Fig. 404). When near the joints the vertical is by no means rare into the joint. The surgeon, in his first examination of the fractured limb, should, if possible, make out the line of obliquity of the fracture and the *tendency* one or other of the fragments may have to ride in any one direction, always observing the utmost gentleness in his manipulation.

In transverse fractures there is rarely deformity; in the oblique it is a common result—the lower fragment being rotated outwards, from the great tendency the foot has towards eversion.

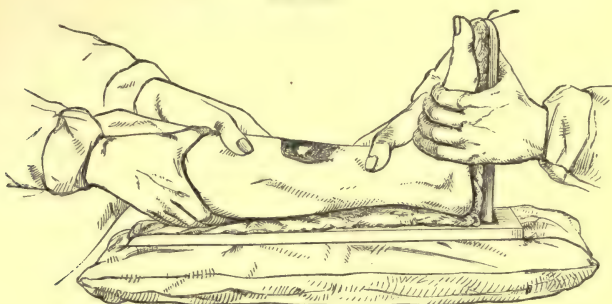
The symptoms of fracture of the leg are too plain to be overlooked. The tibia being a superficial bone, any solution of continuity or deviation of the line of its spine is readily made out, the nature of the accident, loss of power, deformity, and crepitus, helping the diagnosis. In fractures near the joint it may at times be difficult to make out whether the bone is fractured into the joint or not, and when a doubt exists caution in prognosis and treatment is to be observed. In fractures close to the ankle, accompanied with displacement, dislocation may be roughly simulated, but the slightest care ought to detect the true nature of the case; the facility with which the displacement of the parts is rectified, the fact that the malleoli retain their normal relative position with the foot, and that the ankle-joint moves with facility, are abundant evidence to prove that no dislocation of the joint exists, but displacement of broken bones. When the lower epiphysis of the tibia is displaced with the foot, there may be some difficulty in making out the true state of the case, but such an accident can only occur in children; it will appear as a transverse fracture, but with no sharp edge of bone, as is usual in fracture, and replacement of the displaced fragments will not give rise to the ordinary crepitus of broken bone, but to a more subdued sensation.

When a wound complicates the case the diagnosis is readily made.

TREATMENT.—It is wise, in fracture of the leg, as of other bones, to “set” the fracture, and to put the injured limb into the right position with good splints as soon as possible.

In a general way, for fractures of the lower two-thirds of the bones the best apparatus is a straight, flat, and not too broad, metal or wooden pos-

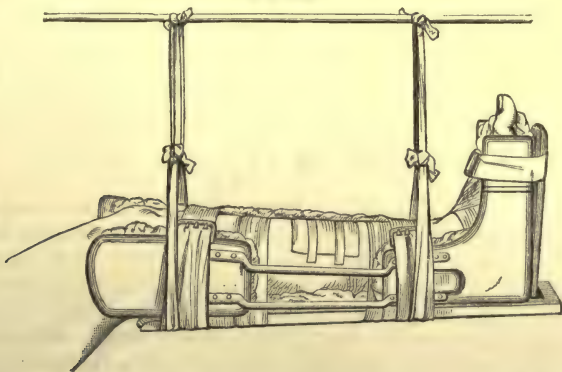
FIG. 452.



terior splint (Fig. 452), with a rectangular foot-piece and two broad lateral splints (Fig. 453), all being well padded and firmly fixed by broad strips of strapping, broad bands of inelastic webbing, or bandages, the seat of fracture being left exposed, if possible, for observation. In Fig. 453 the whole apparatus is illustrated with an interrupted splint as for compound fracture. In reducing a fracture of the leg the knee should be partially flexed or held by an assistant, the surgeon manipulating the lower portion (Fig. 452).

During the putting up of the fracture the limb is to be kept well extended and the broken bones in position, it being a good plan to fix the foot and limb at first to the posterior splint, and then subsequently to apply the lateral. The leg should afterwards always be slung to a cradle by bandages (Fig. 453), or Salter's cradle may be used (Fig. 454), and when any wound in the soft parts exists, as in compound fracture, the corresponding lateral splint should be interrupted, as shown in Fig. 453.

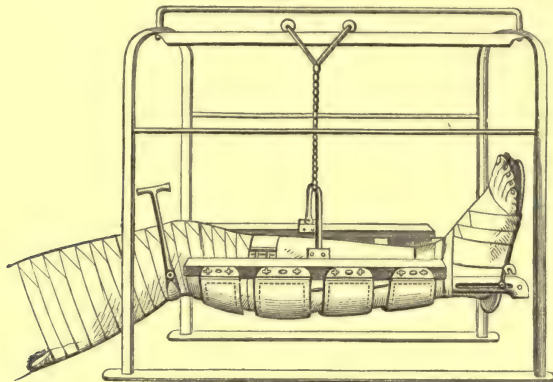
FIG. 453.



When the fracture is close to the ankle-joint and any difficulty is experienced in keeping the broken bones in position, from the spasmodic action of the tendo Achillis, the tendon should be divided, this simple

operation at once allowing the surgeon to adjust the parts with admirable facility, and rendering the retentive apparatus of real value, while it also allows natural processes of repair to go on uninterruptedly, the divided tendon and broken bones undergoing repair together without a drawback.

FIG. 454.



MacIntyre's splint and Salter's swing.

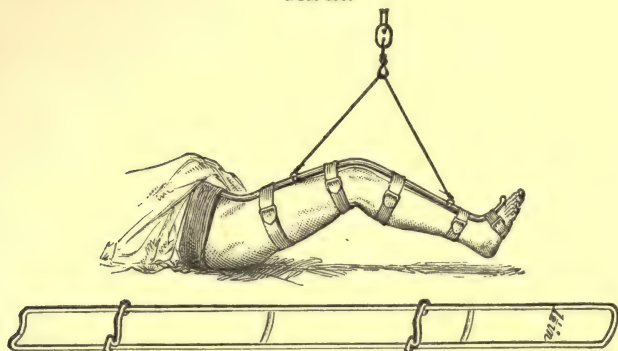
When the fracture is near the knee or into it, a posterior splint, such as that of MacIntyre or Amesbury, may be employed; indeed, some surgeons employ this splint for most fractures of the leg (Fig. 454).

In setting any fracture of the leg the opposite limb should be exposed as a guide, the surgeon's aim being to place the injured one in a like position, an inquiry having been made as to the existence of any natural or acquired deformity, to prevent error. The foot should generally be placed at right angles with the leg, with the sole flat to the foot-piece, care being observed that the heel does not fall and the lower fragment of bone consequently tilt upwards; the heel should also be well protected from pressure, and the foot generally be covered and protected with cotton-wool. "Take, therefore," writes Paget (*"Lancet,"* Feb. 27, 1869), "the foot-piece of the splint as the guide for the position of the foot; and if you do but see, in the management of fractures of the leg, that the foot of the patient and the foot-piece of the back splint fairly correspond, it is hardly possible for the limb to fall into any defective method of repair. Correspondence between the axis of the foot and of the foot-piece insures that there shall be no rotation or version, either outwards or inwards. Then, again, you should be careful that the foot touches the foot-piece by the three balls of the sole,—the ball of the heel, the ball of the great toe, and the ball of the little toe."

Dr. Shrimpton, of Paris, acting upon Dr. Nathan Smith's suggestion of an anterior wire splint, has applied it to fractures of the leg with success. He employs a splint composed of double wires one inch and a half apart, held together by four transverse bars, and applied by means of straps to the front of the leg, as illustrated in Fig. 455 (*"Lancet,"* 1872), the limb being subsequently slung in a vertical direction, much as Esmarch slings his patient's leg in disease or after operations upon the ankle. After the limb has been kept in splints for about a month some immovable apparatus, such as the flannel Bavarian, Fig. 408, may be substituted and the patient allowed to get up, moving about with crutches for another month. When there is little or no displacement and little swelling, as soon as the

immediate effects of the injury have passed away the immovable splint may be applied at once, that is after the first week, the wants of the individual case being the only guide to its treatment. When the bones are

FIG. 455.



Nathan Smith's wire work.

comminuted and some loose portion has a tendency to ride or rise out of its position the application of a pad, with enough local pressure to keep the parts in position, may be employed. When much effusion of blood or local action takes place ice or cold lotion may be used as an application. Constitutional symptoms are to be treated as they arise.

Compound fractures of the leg are to be adjusted as the simple, care being taken to have an interruption in the splint corresponding to the wound (Fig. 453). When the wounds are extensive the posterior hollow splint of MacIntyre, or any of its modifications, may be used with advantage.

When the bones are comminuted the loose pieces should be removed, the wound cleaned and then sealed with a pad saturated with blood, the compound tincture of benzoin, or Lister's carbolic acid, as already described.

When the injury to the soft parts is great, and the large vessels or the joint are involved, amputation may be called for.

About one case in every three cases of fracture of the leg is compound, the average mortality of the compound being also about one in three. Of those amputated about 60 per cent. are fatal.

When amputation is called for, a primary operation, that is during the first three days, is better than a later one.

Fractures of the foot, commonly the result of some crushing force, are always serious, on account of the injury the soft parts have sustained in common with the bones. When not so complicated severe foot bone fractures will recover by rest and the application of cold lotions, &c., as well as other bones.

Fracture of the *os calcis* from a fall from a height may occur; it is seldom associated with any displacement, and undergoes good repair when natural processes are left to themselves. In exceptional cases the broken fragment may be drawn up by the action of the gastrocnemii muscles, and under such circumstances the leg must be kept flexed and the foot extended to keep the fragments in position by some outside splint. Under these circumstances, however, the foot rarely completely recovers its natural use.

Fractures of the *astragalus* also occur from some fall or violence, and

they are mostly compound. I had a case some years ago in which the upper surface of the bone with its head was split off and shot through the skin, and a second in which the bone was crushed into fragments and extruded from below the external malleolus. In the former case the soft parts were so injured that amputation was performed; in the latter recovery took place by natural processes, with a stiff but good limb.

Simple fracture may, however, occur, but it is difficult to diagnose, particularly when no displacement coexists. Recently I had occasion to remove the whole of the necrosed upper articular surface, with half the thickness of the astragalus, from a boy who had had acute inflammation of the bone and joint, following an injury produced by violently kicking against a wall. The piece I removed looked as if it had been fractured, and had subsequently died.

Compound fracture of the *metatarsal* and *phalangeal* bones are to be treated on ordinary principles, the immediate dressing of the wounds with the compound tincture of benzoin, to exclude all air, and place the wound as much as possible under the condition of a subcutaneous one, being very advisable.

CHAPTER LXXXII.

COMPLICATED FRACTURES.

FRACTURES are very often complicated with *extravasation of blood*, and it is a difficult thing to decide in any given case whether an artery or a vein is its source. In compound fractures the difficulty is less than in the simple, for the character of the flowing blood, its pulsatile stream and capability of being arrested, indicates its source; but in simple ones the difficulty is very great, particularly when the limb is simply distended with blood and no pulsation exists. When the vessels below the seat of injury pulsate naturally the blood has probably a venous origin, but when the pulsation is not felt there is no reason to run to the conclusion at once that arterial laceration has taken place, for the vessels may be simply pressed upon by the effused blood. When the swelling itself pulsates the diagnosis is simplified, for such pulsation generally means that a traumatic aneurism has formed, and that some large artery has been ruptured.

In a clinical point of view happily the question is not a very material one, for surgeons are now tolerably well agreed as to the practice to be pursued.

TREATMENT.—In *compound fractures* the injured vessel is to be tied or twisted, the wound being enlarged for the purpose when necessary. Where such a practice is impossible, and the nature of the fracture and condition of the soft parts around render it probable that the limb may be saved, the main artery may be tied higher up, as fractures heal well with a diminished supply of blood. Years ago, when a student, I remember a case of Mr. Bransby Cooper's, in which a compound fracture of the leg was complicated with a laceration of the femoral artery. The artery was secured at the seat of injury, and repair went on well in all respects; as well, indeed, in the fracture as in any case I ever witnessed. Mr. Bransby Cooper has also recorded in his "Surgical Essays" a case of fracture of the femur in which the femoral artery was ligatured for a ruptured popliteal artery, and in which recovery took place in six weeks.

When, however, the condition of the limb at the seat of fracture is such as to forbid any hope of its recovery being entertained, primary amputation had better be performed. When a doubt exists and any probability of the limb being saved is present, the artery must be secured in the wound or above; amputation being then performed as a secondary operation should the attempt to save the limb fail. The chances of a successful result in primary and secondary amputation are about equal.

In *simple fracture*, when the effusion of blood is great, and no pulsation exists, the expectant treatment is the right one to adopt; that is, the limb is to be kept at rest and elevated, and cold applied; in exceptional cases some pressure is of value. When pulsation is present, and it is clear that arterial laceration has taken place, the same practice, in a large number of cases, ought also to be adopted, for every hospital surgeon is aware that these cases often do well under such treatment. I can recall several, where it was as clear as symptoms could make it that fracture of the bones of the leg with severe arterial laceration existed, and yet a good recovery ensued. To cut down at the seat of injury and secure the wounded artery is a practice which no one at the present day advocates, although John Bell laid it down as a law that such a rule should be followed; but to do so above the seat of injury is one that commends itself to the surgeon's attention, when it is clear that some treatment is called for in the wounded vessel, and the fracture and parts around are progressing towards recovery. When gangrene of the limb threatens, it would be as unscientific as useless to adopt the practice; amputation, under such circumstances, is alone applicable.

By way of summary, it would appear that in *compound fracture*, complicated with arterial hemorrhage, the vessel is to be secured in the wound if possible, or above it when such a practice cannot be carried out; amputation, primary or secondary, is to be had recourse to when the local injury forbids any hope of recovery.

In *simple fracture* the expectant treatment is, as a rule, to be adopted, the artery being secured above when interference is absolutely demanded from the progressive character of the hemorrhage; and amputation had recourse to when gangrene of the limb follows; pressure upon the artery is, however, a practice that demands attention.

In exceptional cases it may be expedient to cut down upon the wounded vessel at the seat of injury. In others the only sound practice is amputation, as in rupture of the popliteal artery.

Fractures implicating joints are always grave injuries, although in *simple fractures* the worst effect that is usually to be looked for is some stiffness or ankylosis of the articulation. This result is not, however, constant, a movable joint not rarely being secured; as a matter of precaution, however, the surgeon should warn the patient of the risk. Such cases require very careful treatment, absolute immobility of the joint, as well as of the fracture, being essential points to be observed, and the joint treated if inflamed as other cases of inflamed joint.

The surgeon should, however, be careful always to put the fracture up and fix the joint in the most useful position for a stiff joint.

Compound fractures into joints are amongst the most serious cases the surgeon has to treat, and in the lower extremity they too often require amputation. In the knee-joint when the wound is great and fracture severe, to remove the limb is the best practice, although exceptional cases are on record in which excision has been employed.

In less severe examples an attempt to save the member may be made, secondary amputation being performed should ill success follow; the same

rules are applicable in these cases as in wounds of joints, a simple fissure of bone adding but little to the danger; severe comminution, however, reduces the prospects of success to a minimum.

In compound fracture into the ankle-joint, without displacement, no operation is called for; as a rule, good results are obtained by conservative treatment.

In compound fracture of the shoulder and elbow-joints, amputation is rarely called for, unless the parts are irreparably crushed or the patient is so old as to forbid any hopes being entertained of recovery.

In minor cases excision should be undertaken, it being a wiser practice to excise the articulation at once, with the view of securing movement, than to look for a recovery by natural processes where ankylosis must be expected, unless, indeed, the wound is small and the injury to the bones slight.

In compound fracture of the wrist no operation is, as a rule, called for.

By way of summary, compound fractures into joints are to be regarded much as cases of wounded joint, and are to be treated accordingly, the amount of bone comminution and displacement having an important influence in determining the question and nature of operative interference, should any such be called for.

In large joints, where excision is inexpedient or dangerous, amputation must be had recourse to; in others, where excision is a sound operation, it should be preferred.

In all cases where the ends of the bones project, as in the ankle or wrist, their removal is probably the best practice.

Comminution of bones is another complication that requires a few observations, although in *simple* fractures it does little more than render difficult the treatment of the case and increase the risk of some shortening or deformity. When, however, the result of a blow from a "spent ball" or other projectile, the comminution may be very great, the bone with the soft parts being much confused; the danger of the case under these circumstances is much aggravated, not only from the direct effect of the injury, but from the osteitis that is so prone to follow.

In *compound* fracture it has, however, an important influence for harm, adding greatly to the risks and dangers of suppuration, and diminishing the probabilities of a successful result, for each piece of bone often acts as an irritant and retards recovery, fragments too often subsequently dying. Consequently, it is always well in these cases to remove the detached portions, and when the extremities of the bone are rugged to excise them. Large pieces of bone, however, that are held by their periosteal coverings, are not to be interfered with. This splitting and comminution of bone is most frequently met with in gunshot wounds, the conoidal bullet of the present day splintering far more than the round one of former times.

In all cases of compound fracture where the ends of bone project through the wound it is a wise and expedient practice to remove them with a saw, particularly when they are sharp, and to remove comminuted bone. When much bone has been taken away, the surgeon should be careful not to separate the parts too much, for fear of want of union.

The subject of dislocation and fracture has been discussed in the chapter on dislocations.

Fracture from gunshot wounds will receive attention in the chapter devoted to gunshot injuries.

CHAPTER LXXXIII.

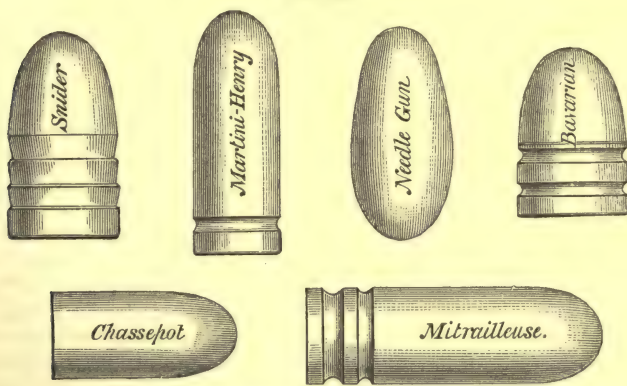
ON GUNSHOT INJURIES.

THESE vary much in their character and nature—the wound from a rifle-ball differing from that of a cannon-ball or shell; and the *direct* effect of a missile upon a part differing from that produced *indirectly* by the scattering of stones or any other hard substance caused by cannon-shot or shell.

Gunshot wounds are also prone to be complicated by the introduction into the wound of some foreign body, such as some portion of the soldier's dress pressed into the wound, or some part of the wadding, shot, or shell itself.

In modern warfare, where the rifle-bullets are of a cylindro-conoidal form, instead of round, as of old, soft parts are more readily penetrated and bones more generally split or splintered; Longmore assures us that such results were rarely noticed from the impact of round balls. From the Prussian needle-gun or the French chassepôt these points—peculiar to the form of the ball and its velocity—were generally observed, but most observers seem to be agreed that there was little difference between the two

FIG. 456.



English and foreign bullets now employed, of natural size.

implements as to the nature of the wound. Although the Prussian and Bavarian balls were said to be larger than those of the French, the wounds produced by both were much alike; if anything, the wound from the needle-gun produced the wider tract and larger opening.

Indeed, in the seton wounds, or wounds penetrating the soft parts alone, of all these balls, it was often difficult to make out the wound of entrance from the wound of exit. When they traversed the soft parts alone they often ran so cleanly through them, that but slight suppuration followed and repair was rapid; these modern balls causing less severe lesions of the soft parts than the old spherical balls. Billroth states that wounds with split-like exits were remarkable for the amount of suppuration that followed.

When bones were struck, no matter what the form of ball, the injury was

alike; there was comminution, vertical splintering, and at times almost pulverization. Indeed, in civil life there is nothing like the splintering and comminution as seen in gunshot wound from rifle-bullets. Between the French and German projectiles there was no difference in these respects.

The amount of alteration in form the projectiles assume after striking a bone is very remarkable—some are completely flattened, others strangely contorted, while many are split.

When the head of a bone is struck it is probably comminuted. When bones are not broken, but only bruised, acute periostitis and endostitis are very common, the concussion of the bone being generally so severe as to excite acute action.

With the rifle-ball the course is more frequently direct than with that from the old smooth-bored musket. Tortuous courses are even now met with, but less frequently, the weight of the ball and the extreme velocity with which it flies producing a more direct route; it penetrates the soft tissues in a direct line, and when it strikes bone it either runs through it or splinters it, entering it like a wedge. It will often appear, writes Longmore, that the track of a bullet even at full speed is widely removed from a straight line. But it usually is not difficult to reconcile the apparent irregularity in the course the projectile has taken if the many varied positions in which the body and its parts are liable to be placed are called in mind, and if, when making the examination, the surgeon takes care to place the patient in a similar position to that he was in when struck.

The injury imparted to soft parts by what are called spent balls or ricochet shots is most destructive, large projectiles moving at low rates of speed possess a force which will crush all parts with which they happen to come in contact, crushing extremities, and rupturing internal organs in a way peculiar to themselves.

A conical rifle-ball, when partially spent, may lodge in a part, either in a bone or some soft tissue. It may take some unusual path and lodge where the surgeon cannot find it, or cannot remove it; and under these circumstances it may rest, become encysted, and give but little trouble. But, on the other hand, it may set up a chronic inflammatory action in the part, and give rise to local suppuration; bullets rarely, however, lodge in the soft parts without giving rise to suppuration, although in bones they may do so. Such cases as these should not, however, induce the surgeon to leave balls alone where they can be taken away; they should always be extracted if possible, unless they should have penetrated any of the great cavities of the body. Billroth speaks very strongly upon this point. In all blind wound tracks of the extremities the finger should be passed into the wound and the foreign body looked for, the external wound being enlarged when needed; and in *non-penetrating* wounds of the head, chest, abdomen, and pelvis, the same practice may be observed. The removal of the ball has not only a beneficial influence on the body of the patient, a cause of irritation being removed, but it has an equally beneficial influence upon the mind, for as long as the ball remains lost in the tissues the soldier naturally regards it as a serious impediment to his recovery, and there is no tonic equal to that caused by its removal. Billroth has found much assistance from Nélaton's sound in doubtful cases, but, as a rule, he says that projectiles that cannot be reached by the fingers can rarely be extracted, the bullet forceps, even the American, being of small value.

When a part of the body is carried away by a *cannon-ball at full speed* the stump will present a level surface of contused and almost pulpified tissues. The muscles and integument, will not have retracted; the extremity of the

broken bone will probably stand out, small fragments of bone being scattered over the surface of the wound.

When the same result follows the contact of a *cannon-ball the force of which is partially expended* there will be evidence of more dragging and laceration of the soft parts, more irregularity of the wound, more hanging of the muscles, greater comminution of the bone, and greater injury to the soft parts above the seat of separation, and probably greater splintering of the bone upwards.

When the force of the *cannon-ball is still less or spent* there may be no separation of impaired parts, but a general contusion, crushing, or disorganization. In some cases, where the force is oblique, there may be no external evidence of injury, this want of external evidence being too commonly associated with broken bones or severe internal laceration of viscera or soft parts; such cases were formerly set down as due to "wind contusions," but are now believed to be caused by oblique contusions of nearly spent cannon-balls, &c.

Shell wounds, as a rule, produce severe laceration of soft parts. They may penetrate tissues, but very rarely pass through them.

The wounds produced by rifle-balls at full speed are at the point of entrance often small, circular, clean cut, and with inverted edges; at the point of exit large, irregular, with everted edges.

As the distance from the weapon increases and the velocity of the ball diminishes so the wound of entrance becomes less circular and regular, larger and more contused; the wound "sometimes consisting of three triangular flaps, which on being lifted up can be made to meet at their apices in the centre of the opening." (Longmore).

When the ball has passed through the part the wound of exit will probably be larger than the projectile, more irregular, torn and everted than that of entrance, the subcutaneous fat often projecting. At times, however, with the cylindro-conoidal bullet discharged at full speed, there is little difference between the two wounds.

The *pain* caused by the gunshot wound depends much upon the parts that are injured. In a general way it is not severe; writers tell us, that it is often described like the sudden stroke of a cane, or the shock of a heavy blow. Sometimes soldiers are unaware of the wound. Longmore relates the case of an officer who from his sensations thought his arm was broken, when on examination no such injury existed, but a ball had passed from right to left through his neck, having probably injured some of the cervical or brachial plexus of nerves, and thus giving rise to his error.

Shock.—"When a large bone is suddenly shattered, a cavity penetrated, an important viscus wounded, a limb carried away by a round shot, the most prominent symptom is the general perturbation and alarm which in most cases instantaneously supervene on the injury. This is generally described as the 'shock' of the gunshot wound. The patient trembles and totters, is pale, complains of being faint, perhaps vomits. His features express extreme anxiety and distress. This emotion is in great measure instinctive, and seems to be sympathy of the whole frame with the part subjected to serious injury, expressed through the nervous system. This shock is more or less persistent, according to circumstances. Examples seem to show that it may occasionally be overpowered altogether, even in most severe injuries, by moral and nervous action of another kind, by a state of mental tension, but this can rarely happen when the injury is a vital one. Panic may lead to similar symptoms of shock, although the wound is of a less serious nature. A soldier, having his thoughts carried away from himself, his whole frame stimulated to the utmost height of excitement

by the continued scenes and circumstances of the fight, when he feels himself wounded is suddenly recalled to a sense of personal danger; and if he be seized with doubt whether his wound is mortal, depression as low as his excitement was high may immediately follow. This depression will vary in degree, according to individual character and intelligence, state of health, and other personal peculiarities. For while, on the one hand, numerous examples occur in every action of men walking to the field hospital for assistance almost unsupported after the loss of an arm or other such severe injury; on the other, men whose wounds are slight in proportion, are quite overcome, and require to be carried."

"As a general rule, however, the graver the injury, the greater and more persistent is the amount of 'shock.' A rifle-bullet which splits up a long bone into many longitudinal fragments inflicts a very much more serious injury than the ordinary fracture effected by the ball from a smooth-bore musket, and the constitutional shock bears like proportion. When a portion of one, or of both, lower extremities is carried away by a cannon-ball, the higher towards the trunk the injury is inflicted the greater the shock, independent of the loss of blood. When a ball has entered the body, though its course be not otherwise indicated, the continuance of shock is a sufficient evidence that some organ essential to life has been implicated in the injury." (Longmore).

Hemorrhage.—The amount of hemorrhage attending a gunshot wound varies according to the size and situation of the wounded vessels. When large vessels are involved death is rapid, and such cases do not come under the notice of the army surgeon.

In the cases that come into the surgeon's hands in a general way there has been an attack of hemorrhage directly after the injury, but little more; possibly some oozing may exist, but rarely much.

When a limb is shot off there is rarely more bleeding than when torn off by the machinery of civil life, large vessels, when torn or twisted, seldom bleeding; in these cases the plugged pulsating extremity of the lacerated artery will generally be found projecting from the wound.

In the wounds of *rifle-balls* vessels escape in a marvellous manner, the great resiliency of large vessels and the freedom with which they slip away under pressure from their loose cellular connections, allowing a ball to pass along or across their course without wounding them. At times the vessel may be so contused as to become obstructed and obliterated. Nevertheless, at times, a rifle-ball may directly divide a large artery and cause instantaneous death. In the American war, amongst the cases of primary gunshot lesions of the arteries that came under treatment, it was found that in most, only a portion of the calibre of the vessel had been carried away, and that retraction had thus been prevented.

Secondary hemorrhage is too common in gunshot wounds, and it is due probably, as a rule, to the reopening of a wound in a vessel temporarily closed, or the sloughing of some part of its walls that had been injured. In the former case the new tissue, that had stopped for a time the flow of blood, gives way under some sudden movement or local mechanical force, such as some foreign body in the wound; or breaks down during the suppurative process or sloughing. In the latter the injured coats of the artery are cast off, having been destroyed by some contusion or other violence; in either case the thrombus or clot in the vessel, is not sufficiently well formed or organized to resist the force of the blood current from behind. When such a clot organizes there will, of course, be no bleeding. "The great frequency of secondary hemorrhage has for its chief causes the absence or faultiness of sanitary conditions, and the debility of the patient, reduced

by privation from nourishing food, and exposure. The means calculated to remove or anticipate such evils will, if applied, be of more value than is the ligature in coping with secondary bleeding after gunshot injury." (MacCormac.)

With respect to the treatment of secondary hemorrhage after gunshot wounds it is, in principle, similar to that which the civil surgeon follows. Styptics, where large vessels are concerned, are worse than useless. Pressure is only applicable for temporary, but not curative, purposes, and thus the surgeon is driven to cut down upon the wounded artery to tie or twist both ends, or to apply the same practice to the vessel in its continuity leading to the seat of bleeding when the former operation is too difficult or dangerous. Billroth advocates dealing with the main trunk of the bleeding vessel at an early period of the hemorrhage, and not to waste time by delay. He says that out of twenty-three cases in which he applied a ligature to large arteries for hemorrhage, in seven death took place from bleeding on its separation, and no clot was found in the vessel; twelve died from hemorrhage and pyæmia, of which no examination was made, and seven alone recovered.

In the late continental war Stromeyer and MacCormac tells us the result of such operations was uniformly unfavorable. Out of twelve cases Stromeyer saw, only two recovered. "I think," he says, "we must decide to amputate oftener in cases of secondary hemorrhage."

Possibly a better result might have followed the use of the carbolized catgut ligature or the torsion of the arteries, for after such a practice, when bleeding has been arrested, there is nothing to set up fresh mischief in the artery, no foreign body like the ordinary ligature, to excite any ulcerative or disorganizing process through which hemorrhage may take place. The thrombus that forms in the vessels after torsion is allowed to go on undisturbed to organize and to become incorporated with the incurved middle arterial coat as one firm organized fibrinous mass, and the catgut ligature is now known to disappear after it has done all that is wanted, and not to set up any ulcerating process.

TREATMENT.—In the front of the battle-field little more can be done in the way of treatment of gunshot wounds than the application of some provisional dressing; some pressure or tourniquet to arrest hemorrhage, when the vessel cannot be at once secured; some splint or other available support to prevent extra injury being inflicted by movement to the field hospital.

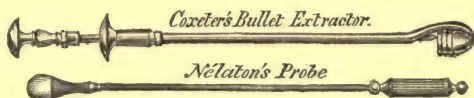
At the field hospital the wound is to be thoroughly and carefully examined, all foreign bodies are to be taken away, bleeding vessels are to be ligatured or twisted; and when necessary the wound is to be enlarged for the purpose. No makeshift of pressure or other temporizing means is to be employed. When great collapse or "shock" exists some gentle stimulant may be given, and at once the true condition of parts is to be made out, and the plan of treatment laid down. Soft parts are to be adjusted, operative interference decided upon when necessary, and right appliances employed.

By far the best instrument to employ in exploring a wound is the finger, and for this purpose the external opening through the fascia may always be enlarged. "No artificial instrument can give the same amount of information or afford information so precise with regard to the lodgment of foreign bodies and their nature as the surgeon's finger can give. The surgeon should not withdraw the finger until the course the projectile has taken, the injury it has done, the complications of the wound, such as the presence of foreign bodies, and, in such a case, their kind and situation, have been decided by him; the exploration will then be completed by one

operation, and a second insertion of the finger for the purpose, which is always irritating to a patient, will be avoided. The knowledge gained, moreover, will be definite and of special utility in determining the proceedings to be afterwards adopted. The exploration is often assisted by pressing the soft parts, especially if the wound be in one of the extremities, from an opposite direction towards the finger end." Sometimes, when a lodged ball cannot otherwise be discovered, it may be found by passing the flat palm of the hand down a limb. "Sometimes," writes Longmore, "it may be detected simply by relaxing the muscular tissues, so as to give a loose and pendulous condition to the parts concerned, and then lightly tossing up the flesh at different points from below with the tips of the fingers."

When sufficient information cannot be acquired through the finger, either from the length of the wound or its tortuosities, probes must be used. Nélaton's (Fig. 457), with a small bell of porcelain at the end, is a good one, or possibly Sayre's snake-jointed probe, with a like end. Longmore likes better than anything a long silver probe, which can be bent to any angle, but speaks highly of Dr. Lecomte's stylet pince; it responds as an indicator with even more distinctness than the Nélaton probe in all cases

FIG. 457.



in which the test would be of service, while it answers for a variety of other cases in which Nélaton's probe would give no indication at all; by it small particles of the substance imbedded in the tissues can be removed for examination, and many foreign substances removed altogether.

In gunshot fractures of the shafts of bones which are to be treated conservatively Stromeyer advises that no probing ought to be performed, and in doubtful or in operation cases it ought only to be done just before the operation or under chloroform.

Electric indicators have been employed, and some are most ingenious, and possibly valuable, but they are not portable; the appliance of Mr. De Wilde, in which contact with the metal of a ball is notified by the sound of a bell, is particularly taking.

A very useful apparatus has also been made by Messrs. Krohne & Sesemann, of Duke Street, Manchester Square. It is designed to ascertain, with absolute certainty, if a substance lodged in the body, and admitting of being touched with the probe or grasped with the forceps, is a bullet, a fragment of a projectile, or other metallic substance. The probe is elastic, and follows the track of any projectile more readily than a stiff probe. Two sharp needles are concealed in it, which, when a hard body is felt, are pushed forward one after the other. This is done by pushing the small buttons on the handles towards the probe. As soon as the two points touch the foreign substance, if it be metal, the electric current passes through the instrument, a fact immediately indicated by the hand on the dial. The hand moves actively either towards the right or left side. The forceps possess this principal advantage,—that they can be used as a probe also, thereby dispensing, in many cases, with the use of the elastic probe altogether. The extremities are furnished with Assalini's points, with which particles of clothing can be removed, if such should lay before the projectile. If a foreign body be touched with the forceps it should be gently grasped between both blades. If it be a bullet or any piece of metallic projectile the

electric current passes through it, and the hand on the dial moves again actively, as described above. It is, of course, necessary to fix the connecting wires of the instrument into the brass heads on each side of the dial. In the drawer below the dial is a small battery charged with sulphate of mercury. If the charge has become too dry and weak it should be moistened with a few drops of water, and a few pinches of sulphate of mercury should be added. It is to be observed that the zinc plate touches the platinum points in the trough.

In exceptional and chronic cases, where time has been allowed to pass, they are of greater use than in primary cases.

It need hardly be asserted again that when a ball has penetrated any of the cavities of the body, such as the head, chest, or abdomen, it is on no account to be searched for.

When a foreign body has been detected it is to be removed; at least such should be the rule. Coxeter's extractor, composed of a scoop for holding and a pin for fixing the bullet, has been highly praised (Fig. 457). Instruments with blades cannot be recommended; they necessitate the dilatation of the wound.

MacCormac writes, "The bullet forceps I preferred was one with claw points, at a right angle with the handle, and slightly overlapping, so as to admit of easy ingress. When these catch the bullet they rarely let it slip. The extraction of bullets, however, requires skill and patience; much injury may be inflicted on surrounding parts by the incautious use of the bullet forceps."

When from the smallness of the wound of entrance force is called for, it is better to enlarge the wound than stretch it. When the foreign body rests beneath the skin an opening through it may be made.

When balls lodge in bone they should be removed as from soft parts; when they can be raised from their bed by an elevator such an instrument should be employed. When forceps are called for for extraction Luer's "sharp-pointed bullet forceps, which bite into and secure a most firm grasp of the object, will best accomplish the extraction." To aid extraction the gouging away of some part of the bone may be called for.

As a rule, however, with rifle-balls the bone is splintered; and under these circumstances, when the epiphysis of the bone is involved, excision of the joint is called for when the joints of the upper extremity or head of the femur are involved, and amputation when those of the knee and ankle are injured.

After the removal of all foreign bodies from the wound, and the parts have been cleansed, they should be carefully adjusted, placed in an easy position at rest, and protected by wet or dry lint, for union by adhesion is out of all question; that by granulation must take place. To hermetically seal a wound is not a practice to be generally recommended. Some gentle support by means of a bandage not only gives comfort, but is of value.

When suppuration has taken place the greatest care is called for in preventing burrowing. As soon as abscesses form they should be opened, and opened freely. When the wounds of entrance and exit are opened the intervening sinus may be syringed out with advantage, some medicated lotion, such as Condy's solution or carbolic acid, one part to a hundred, being used.

Under all circumstances the most thorough cleanliness should be observed, good food with tonics and sedatives given; fresh air being allowed to circulate freely round the beds. Stimulants should be administered with great caution, enough being allowed to assist the digestion of solid food, but little more.

Gunshot wounds of soft parts usually suppurate about the third or fourth day, sloughs mostly separate about the tenth or fourteenth; and recovery takes place in five or six weeks, the wound of exit, as a rule, closing before that of entrance.

Gunshot Wounds of the Head.—A gunshot wound of the head received from a rifle-ball at full speed produces a *diffused* injury to the skull and its contents; when caused by a spent ball or by a fragment of shell, the injury may be *localized*.

In the former cases the external evidence of injury bears no comparison with the real mischief the patient has sustained. In the latter the external evidence may be greater than the internal. Thus, the experience, says Professor Longmore, of the military surgeon leads him always to hesitate in forming a prognosis, however limited a gunshot injury may appear to be at first observation.

Gunshot injuries are, moreover, specially prone to be followed by diffused meningitis, encephalitis, and the formation of deepseated abscesses. This proneness to traumatic inflammation is clearly due to the injury the brain itself with its membranes has sustained; for in head injuries with which the civilian is familiar this tendency to traumatic encephalitis bears a direct proportion to the injury of the cranial contents.

The opening made into the skull by a pistol-ball when at full speed is clean and defined; that of exit is larger and bevelled outwards. They are rarely complicated with fissures. When, however, the velocity of the ball is in a manner modified, there may be the same amount of "starring" at the wound as the civil surgeon sees.

In military practice, as in civil, the inner table of the skull is always fractured to a greater extent than the outer at the point of entrance of the ball, and *vice versa* at the point of exit. (*Vide* Figs. 458-9, taken from Longmore's article in "Holmes's System.")

In military as in civil practice the amount of external injury is no indication of the amount of internal mischief. A spent ball, a fragment of

FIG. 458.

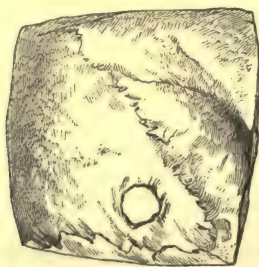
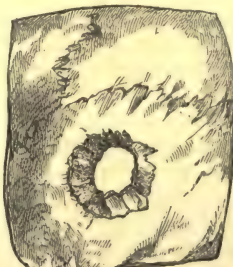
*Wound of Entrance.*

FIG. 459.

*Wound of Exit.*

shell, a stone, may cause what appears to be only a contusion of the scalp, yet a fracture may coexist with such a contusion, and a considerable amount of intracranial mischief follow. "The amount of bruising obvious to sight and the degree of concussion may have seemed trifling, and yet the remote consequences may be serious enough." (Longmore.)

Contused gunshot injuries, without any external evidence of cranial mischief, are at times associated with such intracranial injury as to be followed by a speedy death. "Contusing and glancing shots," says Dr. Neu-

dörfer, of Prague, in his "Manual of Military Surgery," "will either occasion fissures, fractures, or depressions, or not interfere with the integrity of the skull at all, according to the velocity of the projectile and the power and elasticity of resistance of the bones."

Severe scalp wounds are generally caused by the contact of a projectile at an acute angle. Under such circumstances the bone is often left intact, and little or no injury to the brain has resulted.

At a less acute angle the bone may be bruised, scratched, or furrowed, fissured, starred, or comminuted, and with these several conditions more or less severe brain symptoms may be associated, the amount of symptoms depending upon the severity of the concussion.

Concussion in military as in civil experience means either a temporary suspension of brain functions, a contusion or laceration of the brain structure, or a more or less severe extravasation of blood upon or into the brain itself. A severe contusion of the skull without fracture may also produce a fatal laceration of a sinus.

"A simple observation of the injury to the outer table, whether by sight or touch, will by no means necessarily lead to a knowledge of the amount of injury or change of position in the inner table." (Longmore.)

It is quite possible for a piece of the inner table of the skull to be fractured and detached without any fracture of the external. This is illustrated in Figs. 460-1, taken from the drawing of what is believed to be a unique specimen (2313, A. M. M.), in the United States Museum, published in Circular No. 6.

FIG. 460.

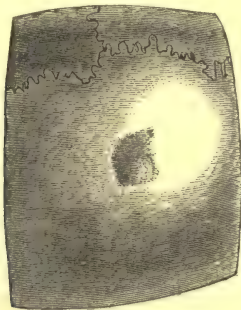


FIG. 461.



Circular No. 6, Figs. 4 and 5, Washington.

Fig. 460.—Exterior view of the forementioned specimen.

Fig. 461.—Fracture of the vitreous table of the frontal bone, without fracture of the external table.

When the external table has been ploughed off by the projectile care should be taken not to mistake such an injury for a fracture of both tables with depression.

In military practice, again, as in civil, *fissured fractures* are mostly the result of diffused blows by heavy projectiles, and fissures of the inner table, without external evidence of the injury, occasionally occur.

Comminuted fractures in both military and civil experience are also mostly local injuries, the force of the ball or blow expending itself on the injured spot.

Wounds complicated with fracture and depressed bone, without lodgment of the projectile, are most serious. Of seventy-six cases recorded after the Crimean campaign, fifty-five proved fatal, and of the twenty-one

survivors twelve had to be invalided; "the severe concussion of the whole osseous sphere by the stroke of the projectile, the bruising and injury to the bony texture immediately surrounding the spot against which it has directly impinged, as well as the contusion of the external soft parts, so that the wound cannot close by the adhesive process, constitute very important differences between gunshot injuries on the one side and others." (Longmore.)

Fractures of the cranium from gunshot wounds are not unfrequently complicated with the retention of the projectile; it may be that the ball had been flattened against the bone and lodged in the wound. It may be that it has been split against the fractured cranium, one portion entering the skull and the other the integument. The segment that enters the skull may lodge either between the bone and the dura mater, or lacerate the membranes and enter the brain. Longmore gives a case in which there was a fissured fracture with slight depression, but no hole in the skull, in which after death half the rifle-bullet was found in the brain. As soon as one-half had entered the skull the door through which it had forced admittance became closed.

Rifle-bullets, however, at the usual speed, in the majority of cases enter the cerebral mass, in some instances to make their exit at the opposite side of the skull, in others to rest beneath the opposite wall; at times the ball takes a circuitous route. In all, however, death, as a rule, follows, no exception to this fact having been reported from the Crimean war.

TREATMENT.—To do nothing active when death appears imminent is a duty the student has to learn, but in the primary treatment of head injuries in the stage of collapse, in military as in civil practice, there is no more stringent rule than to abstain from interference, to wait and watch. The patient should be relieved of all unnecessary dress; no tight belts or garment should be allowed to interfere with the respiration. He should be placed in the horizontal position, and when moved from necessity it should be done as gently as possible. When the extremities are cold some extra covering may be applied, and artificial warmth when possible.

As the case develops, its surgical treatment is to be conducted on precisely similar principles to those that have been laid down in former chapters. Practice is to be established on the preventive principles, to ward off intracerebral inflammation; perfect quiet, cold applications to the head, and liquid food, being the three essentials. Foreign bodies are to be searched after and removed with extreme caution; when they have entered the skull, and even the brain, all search is forbidden; but when at the external orifice they are to be taken away, and the sooner the better. Should a ball be so impacted as to be immovable, the wound in the broken bone may be enlarged to favor its extraction, but no unnecessary interference with the cranium or its contents is to be thought of. All foreign bodies in the integuments outside the skull are to be taken away as soon as discovered.

With respect to the operation of trephining in gunshot wounds of the head the opinion of most surgeons is decidedly against it. When the operation is entertained it is only in compound fractures with depression, attended with brain symptoms. The experience of the Crimean war, of our own as well as of the French surgeons—of the Schleswig-Holstein and Franco-Prussian wars, as recorded by Stromeyer—of the Indian war, as told us by Dr. Williamson—is, without doubt, much against this operation. In the Crimean campaign the trephine was only successfully employed in four cases in our own army, and amongst the French it was for the most part fatal.

The late American war, however, gives us a more favorable result, but

the report itself states that "the data are not sufficiently complete to admit of fair comparative analysis," so judgment must be withheld.

In compound fracture loose fragments may always be removed. In all penetrating wounds of the skull, with lodgment of the projectile, operative interference is out of all question.

As a rule, writes MacCormac, the largest proportion of good results will obtain amongst those cases where the amount of operative surgery has been at a minimum.

By way of summary, it may be remembered that a gunshot injury to the head, followed by a scalp wound, without any cerebral symptom, may be followed by inflammation of the bone and meningitis.

That the vitreous or inner table of the skull may be fissured, depressed, and even detached, without *any fracture* of the external table. The drawings, taken from Circular 6 of the Washington War Department, illustrate the fact (Figs. 460-1), such an accident being probably the result of a small projectile striking the cranium very obliquely. Fissure of the internal table may also coexist with a linear fissure of the external table.

That a ball may gouge out a portion of the external table of the skull without injuring the cranial contents.

That large portions of the whole thickness of the calvaria may be shot away without causing depression.

That a ball, either in part or whole, may partially penetrate the skull and be retained or not, enter it, or pass through it, the wound of exit through the thickness of bone, or through the two sides, being larger than the wound of entrance.

That penetrating and perforating fractures of the cranium terminate favorably in quite exceptional instances.

That hernia or fungus cerebri may take place after gunshot, as after other injuries, and that recovery in these cases may occur, the experience of the surgeons in the American war clearly showing that this result is more likely to take place without than with compression or operative interference.

That trephining may only be undertaken with a fair prospect of success in local fractures with depression and brain symptoms; loose fragments of bone being always removed in all compound wounds.

Gunshot Wounds of the Chest.—These are returned as one in ten among the officers and one in seventeen amongst the men in the Crimean war, and about 30 per cent. of these died; in the American war the mortality was 73 per cent.

Non-penetrating gunshot wounds generally recover, although they are slow in healing, on account of the natural movements of the ribs interrupting the process of repair. They are, moreover, apt to be followed by a pleuritis, on account of the frequency of the ball taking a circuitous course beneath the skin round the walls of the chest. When the chest has been severely contused from a spent ball or a heavy fragment of shell, abscesses are prone to follow the accident, or even necrosis of the ribs, and from the same character of accident without a fracture, the lungs may be injured, as indicated by hæmoptysis, this result being likewise met with in civil practice when the chest is squeezed in young subjects. Professor Longmore states that "ecchymosis, or at least congestion of the lung itself, to a partial extent, in all probability follows every non-penetrating gunshot wound of the chest of much severity." The ribs may likewise be broken and driven in, as in the direct blows of civil life.

Penetrating gunshot wounds are generally fatal, hardly more than one case in ten surviving, and death generally results directly from hemorrhage, or the consequences of consecutive inflammation of the thoracic organs.

The difficulties of diagnosis in these cases are as great as they are in civil practice, particularly if the bullet be small and has entered obliquely near the scapula, or the track of the bullet is covered by sound skin. "It is only," says Longmore, "by a combination of symptoms, rather than by the presence of any one or other symptom, that a lung wound can in many instances be diagnosed." Penetrating wounds, with lodgment of the ball, are more fatal than perforating wounds; a fracture of the rib at the wound of entry renders a penetrating wound more dangerous. When the lung has been wounded from a penetrating shot wound, shock, collapse, escape of air, hemorrhage from the external wound and from the lung, hæmothorax and dyspnoea, are characteristic symptoms. The *shock* is, however, frequently less in penetrating than in non-penetrating wounds when the latter are attended with general concussion. It is remarkable, however, that a lung may at times be completely traversed by a ball, and beyond the hæmoptysis and dyspnoea of the first few days be followed by the most trivial symptoms.

External bleeding in chest injuries is also said to be more commonly due to laceration of an intercostal or the internal mammary artery than to wounded lung.

Internal bleeding is the chief cause of death, and the surgeon has no means at his disposal to make out the exact source of the hemorrhage. A gush of blood from the mouth indicates the opening of a large pulmonary vessel, but in more chronic cases the sources of the bleeding may be pulmonary or parietal. "The situation of the wound of entrance, or the course the ball has taken, inferred from the relative positions of the wounds of entrance and exit, will greatly help to determine the probable site of the bleeding, and to some extent its probable degree of gravity. Internal bleeding from a wounded intercostal artery is very rare."

Gunshot wounds of the heart are always fatal, although not always instantaneously so. In a case recorded in Circular No. 3 of the War Department of Washington the patient survived fifty hours, the pistol-ball having wounded the right auricle.

TREATMENT.—To arrest hemorrhage, to remove fragments of bone or foreign bodies, and to do nothing that can interfere with nature's reparative processes, are the three great principles of practice to be observed. They are, indeed, precisely similar to those the civil surgeon follows. In bleeding from an intercostal artery the best plan is to plug the opening, at least so says Professor Longmore. This may be done in the following way: "A large piece of linen is laid upon that part of the chest in which the wound is placed, and the middle portion of this linen is pressed into the wound by the finger, so as to form a kind of pouch. This pouch is then distended by sponge or lint pushed into it until the pressure arrests the bleeding; on stretching out the corners of the cloth the pressure of the plug will be increased."

If the wound be not attended by hemorrhage it should be cleaned and lightly closed, the side being strapped up to restrain movement. Hermetically sealing gunshot wounds is to be condemned. The patient should be laid on the wounded side with the wound downwards, to allow of the escape of discharges.

In all other respects the treatment of gunshot wounds is similar to others, and the remarks already made are applicable to them. Venesection is less commonly employed now than it was by the surgeons of the Peninsular war; in the American war it appears to have been abandoned. The dangers of inflammation of the chest contents are the chief source of the surgeon's anxiety, and his aim is to prevent them if possible, and when

present to check them. Hemorrhage is to be treated by the application of cold, perfect rest, and the administration of opium. When empyema follows as a secondary result, a free outlet may be made for the accumulated fluid.

Gunshot Wounds of the Abdomen.—These are mostly penetrating, and non-penetrating wounds are often associated with some injury of the abdominal viscera. Longmore tells us that in the Crimean campaign, out of 115 non-penetrating wounds and contusions, 22 deaths occurred, these cases including those of injured viscera. When death follows a non-penetrating wound it is, as a rule, from sloughing of the abdominal walls.

Penetrating gunshot abdominal wounds are mostly fatal, nine out of every ten of the Crimean cases, French and English, having been so recorded; in the American campaign the mortality was 74 per cent. Shock is always very great, and collapse from hemorrhage the most striking symptom. This is, indeed, says Longmore, "sometimes the only symptom which will enable the surgeon to diagnose that the viscera are perforated. The mind remains clear, but the prostration, oppressive anxiety, and restlessness, are intense. Should life be prolonged, signs of peritonitis will soon appear."

In musket-shot wounds it is exceptional for any of the abdominal contents to escape from the opening; when they do, the nature of the wounded viscus will be indicated. The swelling of the margins of the wound accounts for this fact.

Wounds of the *liver* are attended with a large mortality; they are always complicated. Shock and hemorrhage are the usual causes of death; when life is prolonged, peritonitis. Longmore saw only one case of recovery in the Crimea; and Dr. Otis records 4 recoveries, in America, out of 32 cases of this form of injury. In Circular No. 3 of the Washington War Department 4 cases of recovery from this injury out of 15 are recorded, and in one of them the gall-bladder was wounded. Wounds of the *spleen* are almost always fatal from hemorrhage; they are generally complicated with other injuries.

Gunshot wounds of the *stomach* are not always fatal; they are made out to exist when the contents of the organ escape externally, or when from the extent of wound the viscus can be seen; they are always associated with vomiting of blood. Hennen records two good cases of recovery which occurred at Waterloo, and the well-known American case of Alexis St. Martin, reported by Beaumont, is another. Dr. Peters, of the United States Army, has also reported a case that occurred in the American war. Guthrie and Cooper give nine or ten others.

When the wound is incised it should be stitched up. Opium should be given with nutrient enemata. Nothing should be given by the mouth for some days.

Gunshot Wounds of the Intestines are not necessarily fatal, although instances of recovery are rare. Wounds of the large intestine are not so bad as wounds of the small. Hemorrhage, and, if not, peritonitis, is the usual cause of death. Longmore relates one case in which recovery took place. Dr. Hamilton, of New York (1865), quotes eight cases of fecal fistula, which terminated in recovery by natural processes, all having taken place in the late American war; and in the older writers many more might be found. Dr. Habershon has recorded a most interesting case of gunshot wound of the colon through the right loin, the patient dying four years subsequently from albuminuria ("Guy's Reports," 1859).

TREATMENT.—Absolute quiet is the most essential point to be observed in these as in all other cases of abdominal injuries. The recumbent position should be enforced and maintained under all circumstances. Opium

or morphia should also be given in repeated doses, no drug having a better influence in regulating peritoneal inflammation. Absolute cleanliness of the wound should also be observed, but no strapping or closing of the orifice. Simple nutritious food may be given and, as the case progresses, solids may gradually be taken.

Fecal fistulæ appear to have a tendency to close by themselves; in the American cases they gave, in general, but little trouble in their management. (Circ. No. 6, S. G. O., 1865.)

With regard to exploring the track of the wound the surgeon should never forget, says Liddell ("American Quart.," 1867), "that in the management of these cases, art, to be useful, must be the servant of nature, and must seek to do good by assisting her mistress in the efforts at repair, and not by the introduction of new and violent measures which are liable to aggravate the original injury." He believes that the finger should *not* be used for exploratory purposes, or any other instrument, except in special cases. Dr. Otis, however, in Circular No. 3 of the Washington War Department, issued in 1871, p. 87, says that "the mortality of these cases is so great as to furnish an additional argument in behalf of Legouest's proposition to incise the abdominal walls and explore the track of the projectile in certain penetrating wounds. Thus only can the patient exchange the probability of inevitable death for the possibility of recovery, either through the prevention of extravasation by enterorrhaphy, or the bringing of the wounded viscus into apposition with the abdominal walls. For one, I am free to assert that where there is evidence that internal hemorrhage or fecal extravasation is going on, what may be termed the 'ostrich plan' of giving opium and making the patient comfortable should be abandoned; and I believe that prejudices similar to those that ovariectomy has successfully overcome in the last quarter of a century will be dispelled by the results of exploratory incisions in gunshot wounds of the abdomen before many years have elapsed."

Gunshot Wounds of the Bladder do not appear to be so fatal as the cases of ruptured bladder met with in civil life. Liddell reports two such cases in which a good recovery followed, the projectile in both having passed completely through the organ. Guthrie has related six, in all of which recovery took place. MacCormac records a case in which the ball passed through the rectum and bladder, the feces, for a time, passing through the posterior opening, and the urine through the anterior. Both wounds closed by natural processes in seventeen days. In all of these the urine escaped externally through the wound made by the projectile, and thus prevented fatal peritonitis from taking place. Such instances as these indicate the proper practice to be pursued in all cases of ruptured bladder,—cystotomy, as for lateral lithotomy. When foreign bodies have been carried into the bladder they should be removed, for a ball may remain in the bladder and become the nucleus of a calculus. Guthrie, Hennen, Cheselden, and Garengeot have given such cases, and Ballingall has collected nineteen such. In Circular No. 3 of the Washington War Department three cases are recorded in which calculi were removed which had formed on bullets; one in which a stone had concreted upon an arrow-head, and one on necrosed bone.

Gunshot Wounds of the Face are serious from the fact that they are so frequently followed by secondary hemorrhage; and as the deep vessels are usually its source, the difficulties of controlling it are always great. When this complication does not destroy life, good recoveries take place, wounds of the face always healing kindly and with little scar. When there is

much loss of tissue some secondary plastic operation may be called for, and many are the instances of success following the practice.

Gunshot Wounds of the Neck are serious according to the nature of the parts involved. When the large vessels and nerves are injured a fatal result, as a rule, takes place; and when the larynx or trachea is implicated the risks of suffocation are great, not only from the direct result of the injury, but from secondary œdema; when this latter complication occurs tracheotomy should be at once performed. Wounds of the neck are very prone to be followed by septicæmia.

Wounds involving the *vertebræ* are usually fatal, those cases alone recovering where the spinous or transverse processes are the parts injured.

Gunshot Wounds of the Extremities include flesh wounds and contusions, fractures which are rarely simple, and compound fractures, wounds of joints, and compound fractures into joints.

All these may be complicated with some injury to the vessels and nerves of the part, the lodgment of foreign bodies or projectiles. Gunshot flesh wounds, as a rule, do well unless complicated with lesions of the vessels and nerves.

Fractures from Gunshot Wounds are sometimes simple, but more commonly compound. When *simple* they are generally caused by blows from spent balls or other projectiles, the bones being, as a rule, split or comminuted and contused, the soft parts equally suffering, and the bones not rarely being split vertically into a neighboring joint. When *compound* the same comminution and splintering of the bone is commonly present, associated with other complications, such as severe laceration of the soft parts, involving arteries, veins, or nerves, with their attendant dangers, lodgment of fragments, or the whole of the foreign body in the bone or soft parts, and some joint complication from the splitting of the bone into the joint, or from direct injury to the joint.

Military surgeons, however, writes Professor Longmore (in "Holmes's System"), meet with cases of partial fracture. 1. Removal of portion of a bone by the projectile making a furrow in its passage across its surface, grooving it. 2. Removal by splintering off longitudinal fragments from the external cylindrical part of a bone. 3. Removal of part of the bone by completely punching out a portion, thus leaving a hole through the entire substance of the bone. 4. Partial fracture by driving inwards part of the external cylinder and causing the fragment to lodge in the cancellated structure, with or without lodgment of the projectile.

Of complete fractures the peculiarity consists in the comminution and vertical splintering of the bone, and of the complete removal of some part of the shaft of the bone, the term "resecting fractures" being applied to such. One curious effect occasionally produced by the heavy conoidal ball is noticed in Circular 6 of the Washington War Department, in which the bone is fissured and comminuted, though less than is common, at the point at which the ball impinges, while at two or three inches above or below this point a nearly transverse fracture of the shaft is produced; in some of the specimens the transverse fracture is not connected by fissures with the fracture produced by the ball. These injuries are, probably, due to balls fired at short range,

When conoidal bullets, writes Longmore, happen to strike on or below the trochanters of the femur, they usually leave the head and neck of the bone intact, but cause fissures, which often extend to a long distance down the shaft; when they pierce the head, all the parts below usually escape fracture; when the neck is perforated the fracture generally extends both

upwards and downwards. The same rule holds good with regard to the upper extremity of the humerus, although not in so marked a manner.

In all these fractures, from the comminution of the fragments and the concussion the bone has sustained, osteomyelitis and septicæmia are prone to occur. Jules Roux, of Toulon, pointed this out in 1860 ("Bulletin de l'Académie Impériale de Médecine"), and Longmore ("Med.-Chir. Trans.," 1865). J. A. Liddell showed that gunshot contusions of long bones are more fatal from this cause than comminuted gunshot fractures ("American Journal," vol. xlix).

Fractures of the lower extremity are more prone to be followed by such blood poisoning than those of the upper, the point being much determined by the size of the venous canals; the larger and more numerous the veins of a part, the greater the danger of septicæmia.

In gunshot wounds of the pelvic bones Stromeier believes the liability to pyæmia to be very great. He also thinks that cold and exposure favors its development.

Gunshot Fractures of the Upper Extremity are far less fatal than those of the lower, and "unless the bone be extensively injured by a massive projectile, or longitudinal comminution exist to a great extent, especially if also involving a joint, or the state of the patient's health be very unfavorable, attempts should always be made to save the limb." (Longmore.) When the bone is much splintered, examine by the finger for foreign bodies or detached pieces of bone and remove them. Sharp points of projecting spiculæ should be sawn off, the most dependent wound being extended when necessary, or a fresh incision made for the purpose in a dependent position when only one wound exists, the case being then treated as an ordinary compound fracture.

If the shoulder or elbow-joint be opened and the condition of the soft parts, vessels, &c., are not such as to necessitate amputation, excision of the joint should be performed, the experience of all recent campaigns indicating this very strongly.

Gunshot wound of the wrist too often demands amputation; excision is not an expedient operation, and where the major operation is not imperatively demanded attempts to save the limb should be made.

In injuries to the fingers and hand the same remarks apply, and only such portions as are irreparably damaged should be taken away, for the value of a piece of thumb and one finger, of whatever kind, is hardly to be over-estimated, and every effort should be made to save whatever parts can possibly be saved.

Gunshot Fractures of the Lower Extremity are far graver accidents than those of the upper. Longmore lays it down as a general rule that ordinary fractures below the knee from rifle-balls should *never cause* primary amputation; while, excepting in certain special cases, in fracture above the knee amputation is held by most military surgeons to be a *necessary measure*.

The special cases are gunshot fractures of the upper third of the femur, especially if it be doubtful whether the hip-joint is implicated or not; for in these the danger attending amputation is so great that the question is still open whether the safety of the patient is best consulted by excision of the injured portion of the femur, by removal of detached fragments and trusting to natural effects for union, or by resorting to amputation.

The decision of the surgeon must generally rest upon the extent of injury to the soft parts, the age, condition of the patient, and surrounding circumstances. If the femoral artery and vein have been divided, any attempt to preserve the limb will certainly prove fatal.

Amputation at the hip-joint for gunshot wound is generally fatal; so

fatal, indeed, that it ought only to be undertaken when the lower limb is so mutilated as to render it a necessity, or when the great vessels have been injured. When any doubt exists as to the probability of saving the limb the operation should be postponed, and undertaken as a secondary amputation.

The experience of all surgeons, British and Continental, fairly indorses Longmore's conclusion, that in gunshot fractures of the thigh, while the propriety of practicing conservatism in the upper third is clearly indicated, amputation is the safest practice in gunshot fractures of the middle and lower third.

M. Legouest, in an essay published in the "Mem. of the Society of Surgeons" at Paris, believes that amputation at the hip-joint should be reserved for compound fractures complicated with injuries to the great vessels, and he advocates the postponement of the operation as long as possible.

In *gunshot fracture of the head of the femur*, where the soft parts are not greatly injured nor the bone comminuted, *excision* of the bone may be performed, the only case of recovery in the American war from such an injury being where this practice was adopted. In Circular No. 3 two such successful cases are recorded out of three, and they induce Dr. Otis to "add that these instances must place excision at the hip for gunshot injury amongst the established operations of surgery." Out of eighty-seven excisions at the hip for injury, in America, eight recovered.

In *fracture of the thigh* the evil of transporting a patient is so great that Stromeyer says, "I have, during the last campaign, lived to see what I expressed a desire for some years ago, when I wrote, 'Above all things it appears to me to be necessary that cases of gunshot fracture of the thigh should not be transported to a distance, but should be carried on a stretcher to the nearest house, and the treatment carried out there.'" He speaks most highly of the conservative treatment of all gunshot fractures. When operation is called for, primary measures should always be preferred, both for amputation and excision.

In *fracture of the leg* conservatism has even a better chance; that is, where the shaft of the bone is alone implicated; for when the knee is involved, amputation is generally held to be the rule of treatment. Excision is not to be entertained, the results of experience condemning the attempt. Langenbeck, however, in gunshot wounds of the knee recommends conservative treatment; amputation being alone required when the soft parts are severely injured and the bones shattered. He lays, however, the greatest stress upon the necessity of fixing the limb, from the moment of the injury to its cure, in some immovable apparatus, the plaster of Paris splint having his preference, coupled with the application of ice to the part. In gunshot fracture of the shaft of the leg-bones not involving joints the same rules of practice are applicable as have been laid down for the treatment of fracture of the humerus, &c.

In gunshot wounds involving *the ankle-joint* amputation is the best practice; in exceptional instances, where the injury is slight, that is, where the bone is simply split into the joint, an attempt to save the limb may be justifiable. Excision, as a primary operation, is not a good one; as a secondary one, where an attempt to save the limb has been made and failed, Langenbeck's experience is in favor of excision, nine out of eleven cases in which he did it having recovered after the Bohemian war; but to obtain this result he states that the complete immobility of the parts involved by means of the plaster of Paris splint or one of its congeners is indispensable.

With respect to **amputation in gunshot fractures**, every surgeon since Guthrie's time believes that the *primary* should be preferred to the second-

dary. This primary amputation should also be performed as soon after the accident as possible. There is no necessity to wait for the effects of the shock of the accident to pass off, and unless the collapse be very severe the hand of the surgeon need not be stayed; when, however, the collapse is great, some little delay had better be observed, for it is then more than probable that some internal injury or other complication is present to prevent reaction.

Chloroform or any other anæsthetic may be used in military practice, as freely and as fearlessly as in civil. It has a powerful influence in preventing shock, and allowing prolonged or double operations to be performed, which could not otherwise be undertaken, at least without extra risk. In military practice it must be remembered that a limb must often be sacrificed which in civil might be saved; and that amputation is often substituted for excision on account of the impossibility of giving the part the necessary amount of absolute rest and the patient the attention that is only to be found in a civil hospital, "for when active operations are proceeding, and it is necessary to carry the wounded to any distance, the advantage of early removal of shattered limbs is obvious, especially when means of rendering the limbs immovable during the transport are defective, or the transport itself has to be conducted over rough roads or in unsuitable vehicles, and the hopes of success from conservative treatment are thereby reduced almost to zero." (Longmore.)

Dr. Gordon, the British commissioner accredited to the French army in the late war between France and Prussia, tells us that the conclusions the bulk of surgeons arrived at as regards amputation were that it was more suited than excision or resection when its subject had to be carried on with the army; that excision and resection were much more likely to be successful when practiced in the upper than in the lower extremity; that excision of the knee, as a substitute for amputation in case of gunshot wounds of that articulation, has sadly failed; that the practice of conservative surgery in stationary hospitals furnishes no criterion of its suitability in movable hospitals, its requirements involving such attention from the surgeon as can alone be fully carried out when there are comparatively few cases of severity to attend to; in many cases where the limbs are saved they are relatively of little use.

MacCormac urges that the mortality after primary amputation is so very much smaller than that attendant upon secondary that this point cannot be too strongly insisted upon.

CHAPTER LXXXIV.

FEIGNED AND HYSTERICAL DISEASE.

I HAVE placed these two classes of cases together for purposes of convenience, and for no other; both in a measure, and with different degrees of accuracy, simulate real or organic disease, but feigned disease is a deception, hysterical disease a reality. In the *former* case the will of the patient is strong to deceive, it is bent to simulate the symptoms of an affection of which it knows something, but not all, and out of its ignorance detection is to spring, the full knowledge of the surgeon or physician overriding the imperfect knowledge of the impostor and exposing him. In the *latter* case

the will of the patient is weak; functional derangement is allowed to assume the garb of organic disease; subjective symptoms are intensified, not, however, from motives of deception, but from a want of the controlling influence of health, more particularly of the nervous centres, a condition of hyperæsthesia commonly existing from some imperfect nutrition of the nervous centres, due to a want of proper power. In exceptional cases anæsthesia is present, more particularly in the larynx.

Feigned disease is a voluntary deception from the beginning to the end—it is unreal. Hysterical disease is an involuntary exaggeration of some functional derangement—it is real.

In a general point of view feigned affections are attended with an exaggeration of symptoms far beyond those met with in real or organic disease; pain is said to be far more intense than is usually met with, paralysis more complete; every symptom simulated is extreme; inconsistencies are present which are not reconcilable with those usually met with in the disease simulated, and these inconsistencies and exaggerations should always excite suspicion in the mind of the medical or surgical practitioner, and make him test quietly every symptom or group of symptoms, and doubt his diagnosis until he has proved its truth. To the *subjective* symptoms, or those complained of by the patient, these remarks are most applicable; but to the *objective*, or those palpable to the observer, they are so to a degree. The subjective symptoms are always exaggerated, the objective are inconsistent; the former are too bad for truth, the latter are inconsistent with experience.

For example, the rigor of an ague may be simulated, but the hot and the sweating stage cannot well be. Epileptic convulsions, catalepsy, or madness, may undoubtedly be imitated; but in all these there will be when present some exaggeration or inconsistency not found in the real disease. Paralysis can also be readily simulated, but it will, probably, be too complete; it will, on testing, more particularly unexpectedly, be associated with a greater degree of sensibility in the skin than is usually present, or, possibly, hyper-sensibility; when of long standing it will not be attended with the usual wasting. Vomiting, coughing, or spitting of blood, can be artificially produced, but under these circumstances the severity of the symptom will, probably, contrast strangely with the mildness of any others with which it may be attended.

In fact, in feigned diseases, on a careful investigation into the history of the case, the succession of symptoms, their progress, intensity, and duration, some point will be brought out which is irreconcilable with truth; some suspicion that deception is at work will be excited, which, if worked out, will unmask the impostor and prevent error.

With respect to *hysteria*, Skey's assertion was not far from the truth when he asserted "that every part of the body may become, under provocation, the seat of an apparent disease that in reality does not exist; that it may, and often does, assume all the attributes of reality with an exactness of imitation which nothing short of careful and accurate diagnosis can distinguish from the real disease." In joint and spinal disease the truth of this is most frequently seen. Brodie having stated "that among the higher classes of society at least four-fifths of the female patients who are commonly supposed to labor under diseases of the joints labor under hysteria, and nothing else."

How, then, it may well be asked, is the hysterical affection to be made out from the real? How is the surgeon to avoid falling into the error of treating some functional derangement as organic disease?

In a general sense, it may, probably, with truth be laid down that in

hysterical affection of a part local pain and local sensitiveness, on manipulation, are always great, and they bear no relation to the amount of changes visible or detectible in the part. In hysterical disease the slightest touch excites pain, when probably a bold one fails to do so. In hysteria pain rarely, if ever, follows the anatomical course of any nerve or nerves, and the onset of the symptoms is generally more sudden and severe than that usually ushering in organic affections. In fact, all the subjective symptoms are far more severe than the objective, these latter being either very slightly marked or non-existing. For example, a girl is suddenly seized with severe and lasting pain in the hip, knee, or other joint, aggravated by movement or the slightest touch, and yet no visible alteration in its outline or structure can be detected, even after the lapse of many months.

Another is as suddenly affected with spinal affection, as indicated by local pain in the back, inability to stand, &c., &c., without any local evidence of organic disease. A third suddenly finds herself unable to flex or extend a limb, and the slightest force excites severe muscular spasm and pain. A fourth is attacked, without a cause, with some muscular spasm, possibly involving a finger or fingers—a spasm that resists all attempts at extension. A fifth suddenly loses sensation or the power of motion in some part of a limb, quite irrespective of nerve-supply. In these cases, again, however severe the pain may be during the day, it is rarely so at night. Such patients, as a rule, sleep well and quietly. During sleep, also, it often happens that joints which are immovable by day are found to be more flexed or extended. Patients with supposed diseased spine are found on their sides coiled up in a natural attitude. As an aid to diagnosis, the value of some anæsthetic cannot be too highly praised, for with a patient under its influence rigid parts rapidly yield, and supposed paralyzed parts often move, suspected joint disease disappearing by a close examination where before doubt existed.

Hysterical disease is more commonly met with in female than in male subjects, in the single than in the married, in those whose nervous systems have been unstrung from some mental or physical trial, or in those whose emotional centres are inadequately balanced by the higher controlling ganglia. It is characterized by the suddenness of its attack and the severity of all its subjective symptoms, neither the clinical history of the case nor the objective symptoms present being consistent with those usually met with in organic disease; the exaggeration of certain symptoms and the absence of others, the suddenness of the attack and the anomalies of its nature, mark the hysterical affection over the organic, and are enough to excite a doubt in the surgeon's mind as to the true nature of the affection.

For valuable information on this subject the reader may be referred to the lectures of Brodie and Skey.

CHAPTER LXXXV.

AFFECTIONS OF THE MUSCLES AND TENDONS.

CONTUSIONS of muscles may occur as of other parts, and when severe they may be followed, not only by want of power, but by absolute wasting; thus, in 1863 I saw a man, æt. 44, who, five months before, received a severe contusion of the left deltoid muscle from a fall upon the shoulder,

and, as a consequence, the muscle had completely atrophied; there was no loss of sensation over the muscle, and in all other respects the limb was normal.

When wasting takes place the muscle should be stimulated by galvanism before degeneration has proceeded too far. When the result of want of nerve force, there is but little hope of any good result being obtained under any treatment.

Subcutaneous Rupture of Muscle, to a slight degree, is far from being uncommon, but its complete rupture is very rare. In most cases of strains some rupture of a muscle takes place, and this often shows itself by the effusion of blood into the part.

At times a muscle is torn across by overaction, as in tetanus, the rectus abdominis being the one most frequently affected, but the psoas has been said to be so implicated by Mr. Earle. Sédillot reports that out of twenty-eight cases of ruptured muscle thirteen occurred at its point of juncture with the tendon. He says also that rupture only occurs in some involuntary action of the muscle, or when it is taken unawares. In 1859 I attended a man, æt. 21, who ruptured the left rectus abdominis above the umbilicus when jumping with some bricks in his hand. He was collapsed after the accident, and when I saw him the next day the two ends of the muscle were so far asunder as to allow the fingers to be placed between them.

In 1863 I also attended a man, æt. 65, who, when lifting a cask with his body bent, felt an acute pain in the posterior part of one thigh, "as if he had been struck with a potato;" he fell forwards, and was unable to walk. When I saw him, two days after the accident, the semi-membranosus muscle at its origin from the tuber ischii had clearly been divided; the body of the muscle was to be felt as a loose, fleshy mass, and below the tuberosity of the ischium a marked deficiency was present. I have also the notes of a case of complete laceration of the extensor triceps muscle of the thigh, above the patella, in a railway inspector, who said it gave way with a report on attempting to start off suddenly for a run. There was great effusion of blood into the part within a few hours; when this had subsided, after the application of ice, the separation of the muscle from the patella was very distinct.

Minor degrees of laceration of muscles are of common occurrence, and are often followed for many months by pain, stiffness, and want of power in the part, the pain disappearing for a time to reappear on any overaction of the weakened muscle. The pains are often called rheumatic.

Mr. Poland records in his "Fothergilian Prize Essay" two cases of complete rupture of the rectus abdominis muscle in the hypogastric region, so that the finger could be laid in the dents between the retracted ends. These both occurred in the wards of Guy's Hospital, and in men of advanced years suffering under organic disease, the one had an advanced stage of bladder and kidney mischief the sequelæ of old stricture, the other was suffering from a relapse after continued fever. In both the accident had been caused by a fall across the iron rods of the bedstead in a vain attempt to rise and walk. Both died a few days after the accident, when complete rupture of the rectus was found in the middle of the hypogastric region. Coagulated blood was present between the divided ends, as if only just poured out. No signs of repair existed.

TREATMENT.—In all cases of completely ruptured muscle the parts must be relaxed, in order that the divided ends may be made to approximate as much as possible and fixed at rest, so that repair is not interrupted. When much effusion of blood or serum follows, ice may be applied in a bag; and

when absorption has somewhat advanced, some stimulating liniment hastens recovery and gives comfort. When these points are not attended to, repair will not go on; indeed, as a consequence of neglect, suppuration is by no means a rare result, as is seen in psoas abscess. When the laceration has been complete, permanent weakness will remain, and when the abdominal muscles are at fault some hernial protrusion of the abdominal contents will take place. In a man who fell from a ship's ladder upon a blunt-pointed iron bar, and had severe rupture of the abdominal muscles attached to the anterior half of the crest of the ilium, a large hernial protrusion existed. I could press my fist into the opening through the muscles. In such cases as these some artificial support is permanently needed.

Compound Laceration of Muscle.—When muscles are lacerated in connection with wounds of the soft parts covering them in, the injury is a grave one, and in proportion to the amount of laceration is the primary danger of the case, and the prognosis as to the future use of the part unfavorable. In compound fractures, &c., this fact is well known.

But at times muscles are torn out of skin wounds, or are ruptured at the time of the accident, and may even hang out of the wound. When this is the case the muscle, unless much crushed or injured, is not to be cut away; it is to be replaced in position as well as possible, the wound in the soft parts being enlarged, if necessary, to further this end. One of the worst cases of this kind I have ever seen I attended with Dr. Mason, of the Barbican; it was in the person of a gentleman, æt. 22, who fell out of a window on to a glass skylight, a height of forty feet or more, when sleep-walking. Besides other injuries, he sustained a lacerated wound of his right thigh, and complete division of the body of the inner hamstring muscles. When I saw him a large mass of well-developed muscle protruded from the skin wound; I enlarged the opening in the integument, and carefully replaced the muscle, keeping the limb on a splint, and in five weeks he was convalescent. Time has yet to prove what movement will ensue.

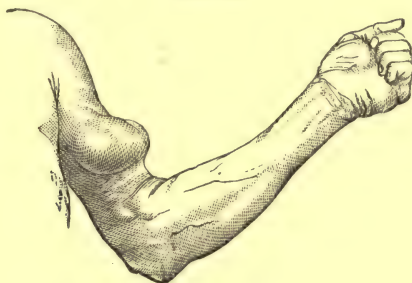
Dislocation of Tendons.—That such an accident occurs irrespectively of fracture or other severe injuries is to be admitted, although it is by no means a frequent one. In 1869 I had under my care one well-marked example of dislocation of the peroneus longus tendon in a woman, æt. 29. It came on some ten days before, when walking, with a sudden pain behind the external malleolus, leading her to think she had been struck with a stone; she was at once disabled and experienced severe pain in the part; on rubbing her ankle at the time she felt a cord in front of the bone which slipped in on moving the foot. Since then any movement of the ankle caused the same cord to appear. When I saw her the tendon of the peroneus longus muscle was readily displaced from its groove behind the external malleolus by giving the foot the slightest twist; it passed obliquely across the bone and could be rolled under the finger. It was readily replaced on abducting the foot, but it was kept in its position with great difficulty. The best means were found to be a good pad of lint fixed over the ankle and behind it by means of strapping. I saw her one month after and the tendon seemed fixed in its place; she could walk without pain or stiffness. The bandage and pad were reapplied and directions given to keep them on for a month.

It is a question whether any other tendon can be similarly displaced; it has been said that the long tendon of the biceps may be, but it has never been demonstrated.

Rupture of Tendon is more common than rupture of the body of a muscle, tendons usually giving way at their muscular or bony origin. The accident mostly occurs in subjects past middle life. The long biceps tendon

not rarely gives at its upper end, and when it does it imparts to the biceps muscle, on contraction, a peculiar appearance, its inner or coracoid half contracting into a hard knot (Fig. 462), its outer remaining lax and but slightly altered. This swelling has been mistaken for tumor of the muscle of the arm. When the one tendon gives, the other usually follows at a later date, this fact clearly indicating that they give way from some disease which affects their elasticity. In a case I treated in 1858 the two tendons gave way at the interval of four months, and the arm became black and blue after the accident. The tendo Achillis rarely snaps; the plantaris does occasionally, and when it does it causes a peculiar dragging of the foot and its eversion.

FIG. 462.

Ruptured long tendon of biceps. Drawing 37⁰⁰.

In one case which I saw, a few hours after the accident, in a man *æt.* 27, this symptom was so marked and peculiar as to make it a pathognomonic one in my mind. It was caused in taking a step of two and a half feet, up into a vessel with a load on his back; on raising the posterior part of the heel from the ground it gave way with a snap.

I have likewise the notes of a case of rupture of the tendon of the *biceps femoris*; it took place in a boy, *æt.* 8, who, when hanging on behind a four-wheeled cab, got one of his legs entangled in the wheel. When admitted into Guy's, directly after the accident, the tendon of the biceps femoris was made out to have been ruptured at its insertion into the fibula; there was a marked depression at this point, with ecchymosis; the limb was flexed and fixed on an outside splint and a good recovery ensued, although there was some weakness of the muscles supplied by the external popliteal nerve, which had apparently been injured at the same time.

Looking upon the ligamentum patella as a tendon, the following example of its rupture may be recorded.

In 1867 I was called upon to treat a man, *æt.* 31, for an injury he had sustained to his right knee ten days previously, in attempting to save himself from falling backwards. The knee swelled up after the accident and became acutely painful, and when I saw him the patella was drawn up for at least an inch, the ligament having been divided. I treated the case as for fractured patella with a posterior splint, and employed pressure to bring the patella downwards, but was unable to alter its position to any extent. He recovered, however, with a useful limb.

Muscles and tendons may be cut like other parts, and when cut they separate directly; they are to be treated like ruptured tendons or muscles, by adopting such means as are necessary to bring the divided ends together and to keep them there, splints, bandages, and position, being brought into requisition according to the wants of the individual case. The parts should

be kept in apposition for, at least, one month or six weeks, otherwise some stretching of the uniting medium will take place and permanent weakness or deformity.

In certain cases of divided tendons sutures may be introduced; several cases are on record in which such treatment was successful.

In wounds where muscles and tendons unite by granulation some stiffness and want of power in the part will remain for a long time, or possibly forever. But in healthy subjects it is remarkable how tendons, at one time fixed, subsequently free themselves from their surrounding attachments and become free again. This hope may always be held out to a patient who takes a gloomy view of his own prospects.

Inflammation of muscle is a recognized affection; it occurs as a consequence of some strain or partial rupture of its fibres, as well as independently of any such cause. It is the more common as a result of injury, and is seen not seldom in the rectus abdominis as well as in the psoas muscle; indeed, as a cause of psoas abscess I believe it to be more common than spinal disease; as a secondary deposit in septicæmia it is frequently met with; it is found in every muscle, even the heart. It appears as a more or less acute affection of the muscle, by swelling, local pain, and constitutional disturbance, suppuration appearing in due time. The symptoms rarely come on directly after the injury, but, probably, after the lapse of several weeks, as a consequence of some want of repair in the injured part, from the non-observance of the necessary rest which an injured muscle so much requires in the process of healing. When an abscess forms in a muscle the sooner it is opened the better, recovery readily following after the adoption of this practice when the disease is local, even in such a muscular organ as the tongue. Inflammation of muscle, as an independent affection, is generally chronic, and in adults is mostly of syphilitic origin.

In infants it is met with most commonly as an affection of the sterno-mastoid muscle; the body of the muscle, wholly or in part, appearing as an indurated mass; it is generally observed soon after birth, and I have thought it could be usually traced to some injury sustained at that time, but this cannot always be done. I have seen it in children the offspring of syphilitic parents, but more frequently when no such history or suspicion existed, and in the last fifteen cases a syphilitic history could be obtained in only one. These cases in infants rarely, if ever, suppurate; they go on to a natural recovery, as the power of the infant improves. I simply prescribe for such warm fomentations and some simple tonic, as cod-liver oil. I have never seen a case fail to recover by these means.

The student should remember that this affection appears as a simple induration of the muscle; it is, therefore, unlike any glandular or other affection.

In adults chronic inflammation of the sterno-mastoid is met with, but I believe mostly as a consequence of syphilitic disease; it appears, in fact, as a gummy tumor or infiltration of the muscle, as it exists in other muscles, such as the tongue, extensor triceps of the thigh and of the arm, of the temporal or masseter muscles, or, indeed, of any part. The muscle or muscles become infiltrated with syphilitic inflammatory products, or, more rarely, the seat of distinct gummy tumors. These tumors, if their nature is recognized and right treatment employed, may be reabsorbed; but if neglected and left alone they will, after attaining their full size, which is rarely great, break up and suppurate, giving rise to deep-seated abscesses, which, when they have discharged externally, leave deep, irregular, excavated sores; in the tongue these simulate closely cancerous sores; many of the cases of supposed cured cancer of the tongue being doubtless of this

origin. In other parts they have much the aspect of the deep cellular membranous ulcers which have been already described. As a part of syphilis, they always appear late in its history, and remote from the primary inoculation. When this disease appears in the adult, in the sterno-mastoid muscle, it more frequently attacks its sternal end than its body.

After the disease has gone atrophy of the affected muscle is a common consequence. At times contraction follows, although I have never seen it. MM. Ricord and Notta have, however, recorded examples.

Recognizing the syphilitic nature of this affection, the treatment is to be conducted on rational principles; large doses of the iodide of potassium—say fifteen to thirty grains—may be given three times a day with advantage; not, however, in such full doses at first, but by gradual increase from one of five grains. Mercury may at times be given, the mercurial suppository once or twice a day being the best form; but in the chapter on syphilis this practice will be found in detail.

Atrophy of Muscle.—The surgeon sees this under a great variety of circumstances. He is the most familiar with it as a consequence of want of use in disease of the joints, or any other affection in which the limb is kept at rest; and under these circumstances the muscles simply waste; they undergo no other change in structure; they are capable of a complete restoration on the reassumption of their normal action.

In a large number of cases of infantile paralysis the same thing may also be said, for under the stimulus of galvanism, persevered in for many months, the thinnest limbs plump up, and the feeblest muscles become capable of performing the work they were made for. Indeed, when deformity does not complicate the case a good result may be looked for.

After fevers, however, lead poisoning, rheumatism, scrivener's palsy, and alcoholism, the muscles may undergo genuine degeneration, either granular, fatty, or waxy, at least so Lockhart Clarke tells us, and his authority is too great to be disputed. He tells us also that "there is another form of this malady, which is known by the name of *progressive muscular atrophy* (Cruveilhier), *atrophie musculaire graisseuse progressive* (Duchenne), and *wasting palsy*. This curious disease differs in several respects from the other atrophies. It is always chronic, but of uncertain duration, is frequently hereditary, is capricious or irregular in its invasion, prone to spread from one part to another, or become general, and thus go on to a fatal termination. The affected muscles suffer different degrees of wasting, and assume a variety of aspects. Even in the same muscle bundles in different stages of atrophy and degeneration may be found at the side of others that have retained their normal state. When the wasting is extreme in all the bundles, a long muscle may be reduced to a mere fibrous and cylindrical cord, or to a kind of tendon, and a flat muscle may be reduced in the same manner to a kind of membrane. In some instances the atrophy may be *simple*, that is, the muscular tissue may be wasted to a considerable degree without any granular or fatty degeneration; but generally one or both of these alterations of structure is found to exist to a greater or less extent. The muscle also changes and varies in color, according to the nature and degree of the atrophy. It is paler than natural; occasionally it is quite colorless, like the flesh of fish, or it may have a faint yellow or ochreous tint. Its consistence for the most part is increased in consequence of the increase in the interfibrillar connective tissue. When examined under the microscope the affected muscles may be seen to have lost, to a variable extent and degree, or even entirely, the appearance of transverse and longitudinal striation, while in a corresponding proportion the sarcous or muscular element is transformed into granules, which in some instances are too fine to be dis-

tinguished as separate particles. The granules are soluble in acetic acid. In this odd affection the granular, fatty, and waxy degenerations are found side by side." ("Holmes's Syst.," 2d edit., vol. iii.)

This disease is said to appear more commonly in the right upper extremity, and in the hand, progressing upwards to the trunk, and then over it to the lower extremities, where it rarely commences. It begins with loss of power in the part, but rarely with any loss of sensation, this symptom gradually increasing; want of muscular co-ordination soon appears, and awkwardness in the patient's movements, cramps, twitches, and fibrillary tremors soon appear, occasionally with pain or some cutaneous anæsthesia. Cruveilhier believed that atrophy of the motor nerves was the starting-point of this disease; but this theory is not now entertained, Lockhart Clarke telling us that "in 1861 I discovered, in the spinal cord removed from a well-marked case of this disease, numerous lesions of the gray substance, consisting chiefly of areas of what I call granular and fluid disintegration; and I have seen the same in other cases since." This view is now held by Trousseau, Duchenne, Meryon, Roberts, Cohn, and others.

This disease is generally hereditary, and more common in males than females. It is excited by excessive muscular exertion, cold and damp, and injuries or diseases of the spine, syphilitic or otherwise.

TREATMENT.—Removal of the cause is the primary object, and when syphilis is suspected special treatment should be employed. Tonics are always of use, and arsenic, in Dr. Meryon's hands, has met with good success; "but of all remedies hitherto employed galvanism is undoubtedly the most useful when applied to the affected muscles" (Clarke); on the same authority setons and blisters to the spine may be employed in the early stage.

Degeneration of muscles with apparent hypertrophy, called Duchenne's disease, after its first describer, in 1858, is a strange affection, which attacks children, but continues on in life to an advanced period of youth. It begins with weakness of the lower limbs, which is lasting, and passes on to a progressive enlargement of the gastrocnemii, then of the glutei and lumbar muscles, occasionally of all the muscles. The muscles feel firm and elastic, and on contraction hard; after a variable period, at times years, the paralysis gradually increases, and becomes more general. "The patient is no longer able to stand upright, the upper extremities become affected, the enlarged muscles rapidly decrease in volume, and the limbs and trunk become atrophied *en masse*. In this state the patient may exist for a considerable time, but ultimately dies by intercurrent disease. Many of the children affected with this singular disorder have dull intellects, and are more or less idiotic." (Clarke.) Pathologically, great hypertrophy of the connective tissue of the muscles is to be found, the fibres themselves showing finer striæ and being transparent, large collections of fat-cells coexisting. Medically and surgically, no treatment seems to be of use.

Muscles at times ossify, either in parts or in groups. In the College of Surgeons a specimen exists in which nearly all the muscles of the back had become ossified, and at St. George's Hospital a similar preparation exists, of a case recorded by Cæsar Hawkins ("Med. Gaz.," 1844). The disease is supposed to be inflammatory in its origin. Some years ago one of my colleagues at Guy's excised a piece of bone from the body of the deltoid muscle, one inch long, the growth of seven years.

Tumors in Muscle.—These are of rare occurrence, and those met with are mostly of the fibrous or fibro-cartilaginous kind. In 1866 I excised one of two years' growth from the fleshy portion of the external oblique muscle of a woman, æt. 31 ("Path. Soc. Trans.," vol. xviii). The tumor

separated the fibres of the muscle which it infiltrated, and, microscopically, it had all the elements of the fibro-plastic tumors; it returned within the year, and when I last saw her, in 1869, there was a second growth the size of a cocoanut occupying the place of the original tumor. In 1868, also, with Dr. Burchell, of Kingsland, I removed a myxomatous tumor, eight or nine inches in diameter, from the abdominal muscles of a woman, æt. 33, of two years' growth. Others of a later or analogous kind are on record; they are always of a serious nature.

Cancerous growths may originate in, but more frequently infiltrate muscles as secondary growths. Surgeons see this in the pectoral muscles, in acute or neglected cases of cancer of the breast, as well as in other parts; in the tongue and lip it may be regarded as a new growth.

Hydatids, likewise, are found in muscles as in every other tissue, as painless, tense, globular swellings, as well as that curious nematode worm the *Trichina spiralis*, which, in man, seems to be taken into the body through eating the insufficiently cooked flesh of animals, particularly pigs, infested with them.

"*Trichinæ*, as ordinarily observed in the human muscle, present the form of spirally coiled worms in the interior of small, globular, or lemon-shaped cysts, which latter appear as minute specks scarcely visible to the naked eye. These specks sometimes resemble little particles of lime, and are more or less calcareous externally, according to the degree of degeneration which their walls have undergone; these cysts are not, however, essential." (Cobbold.)

When these worms are present in large numbers in the body they give rise to a disease known as trichiniasis, which is most fatal. Drs. Boehler and Königsdöffer, of Central Saxony, who first saw this disease, according to Leuckart who described it, state that "the affection began with a sense of prostration, attended with extreme painfulness of the limbs; and after these symptoms had lasted several days, an enormous swelling of the face very suddenly supervened. The pain occasioned by this swelling and the fever troubled the patients night and day. In serious cases the patients could not voluntarily extend their limbs, nor at any time without pain; they lay mostly with their arms and legs half bent—heavily, as it were, and almost motionless, like logs. Afterwards, in the more serious cases, during the second and third week, an extremely painful and general swelling of the body took place," a large proportion of the cases dying. Dr. Thudichum has given an able report on this subject in the "Medical Officers' Report" to the Privy Council, 1864.

Vascular tumors of muscle have been made the subject of a special paper by Mr. C. De Morgan ("Brit. & For. Med.-Chir. Rev.," 1864). They are very rare. They exist as vascular tumors of erectile tissue, involving a muscle, without as well as with a capsule, or as tumors having the appearance of varicose veins around the muscle.

They are mostly congenital, although not always, and are generally found in the lower extremities. They have no definite clinical history beyond their gradual and painless increase. My colleague, Mr. Howse, not many months ago excised such a growth from the biceps muscle of the thigh of a woman, æt. 23; it was not encapsuled, but was made up of erectile tissue and highly vascular; it had been growing for eight years. Mr. Howse excised all the muscle that was involved, but left its tendon; a good recovery ensued and free movement of the limb.

Mr. Teevan has published an able paper on tumors in muscle in the "Brit. & For. Med.-Chir. Rev." for 1864.

Tumors of Tendon.—Besides ganglion, other tumors are found connected

with tendon, and of these the cartilaginous and fibrous tumors are the most common. Some are said to begin as ganglion and subsequently to consolidate. I have seen one composed of bone and cartilage of two years' growth removed from the extensor tendon of the hand said to have such an origin. Tumors with tendons passing through them are not rare, and on two occasions I have had to amputate the hand of a child for a cancerous tumor occupying its palm through which all the flexor tendons passed (Fig. 463); and in 1867 I removed from a boy, *æt.* 3 $\frac{3}{8}$, a congenital tumor the size of a walnut, which evidently grew from the theca of the tendon of the long extensor muscle of the thumb; the tendon passed through the tumor which surrounded it. Dr. Moxon and I examined the growth, which was clearly composed of fat or condensed fibro-cellular tissue.

FIG. 463.



Cancerous tumor of the hand.—Dorsal aspect.

The majority of tumors, however, connected with tendons are of the nature of ganglion more or less indurated.

What has been described as *the rider's bone* is probably at first an inflammatory infiltration in, and subsequently an ossification of, the tendon of the pelvic origin of the adductor longus or magnus muscle. I have such a case now under observation in the person of a medical friend, *æt.* 44, who is addicted to hunting. It occurred in November, 1869, after a violent effort to grip his horse when about to make a long jump; the effort was not attended with any pain, but was followed by much ecchymosis, extending down to the knee, and loss of power in the muscles of the part. When these symptoms had subsided a dense induration was felt in the pubic origin of the right adductor longus muscle, which was painful on manipulation; as months passed this induration not only lasted, but became more dense. When I first saw him, about three months after the accident, it was clearly in the tendon of the adductor longus, and movable with it. It has grown somewhat during the last two years, and when the tendon is rigid it appears as an outgrowth from the pubis, corresponding to the origin of the adductor longus, of about two inches length; when the muscle is relaxed it is as clearly only in the tendon; it has no bony origin. At the present time this gentleman can take his exercise as usual. There is a distinct grating to be heard and felt on moving the tumor, which has not grown for the last six months. The history of this case is identical with that given by Birkett ("Guy's Hosp. Rep.," 1868). Billroth has also described this affection.

Virchow is said by Holmes to have recorded the fact that a similar ossification of the muscles of the left arm of the Prussian soldier takes place, and is termed "exercise bone."

Inflammation of Tendons.—When acute, this affection is a most serious one; it is seen as a consequence of some severe strain or laceration of tendon, some punctured or other wound involving the sheath; it may begin in one toe or finger, and spread upwards to the palm, and in that way spread to other tendons, and even up the forearm. It is accompanied by severe local and constitutional symptoms. The local are pain, with the external evidences of inflammation, heat, redness, and swelling, the swelling being deepseated; the pain soon extends beyond the seat of mischief up

the arm, and if relief be not given the other local symptoms rapidly spread. The constitutional symptoms are those of more or less severe pyrexia.

If surgical interference is not brought to bear upon the case suppuration will soon appear, with the local symptoms of throbbing and aggravated local distress, and the constitutional symptoms of rigors, excitement, and depression; inflammation of the absorbents and their glands, probably complicating the case.

Under still more neglect sloughing of the affected tendons will take place, and diffused inflammation with suppuration of all the parts involved in the disease, the local effects of the affection being determined by their boundary. A finger, hand, or forearm may be jeopardized or sacrificed, according to the active nature of the inflammation or active treatment with which it is met.

Absorbent inflammation and blood-poisoning (septicæmia) are common concomitants of this affection.

TREATMENT.—The surgeon has more power in controlling this affection than in most others; and in opening the swollen part and relieving the tension more good is done in arresting its progress than by any other means; the operation not only relieves pain, which is caused by the tension of the fibrous tissues from the effusion beneath, but arrests the progress of the affection, by preventing the inflammatory effusion burrowing up the theca of the tendon, and in this way neutralizing the tendency there is for the distended fibrous tissues to die from mechanical causes, the result of the pressure produced by the effusion.

For these objects the surgeon should, under all circumstances, as soon as hardness of the parts appears, with external evidence of inflammation, make a clean cut down to the theca, and let out its contents. Should pus escape, the practice must be good, and should serum only, the operation will tend to arrest at the onset the progress of the affection, prevent the formation of pus, and probably check the disease. The incision should be always made in the vertical direction, over the middle line of the finger and the centre of the tendon; in this way no vessel or nerve of importance is likely to be wounded.

When suppuration exists the surgeon must follow up with his lancet every line of inflammation and suppuration, for in no tissue does more harm ensue from retained fluids than in the fibrous.

In the very earliest stage of the inflammation warm fomentations and possibly leeching may be of use. Elevation of the limb undoubtedly relieves pain, and a saline purgative is often of value. But the surgeon must not lose time by such temporizing means; for tension of the part means its death, if not mechanically relieved, and medicines, &c., have no material influence in its control. When suppuration appears, tonics and liberal diet are required, with stimulants carefully adjusted to the necessities of the case. Sedatives are always wanted, in some one of their forms. Morphia, in quarter or half-grain doses, subcutaneously given, acts the most rapidly. The limb should always be well raised, the hand being higher than the elbow, and the elbow than the shoulder. Water-dressing or poultices should be applied. In very severe cases, when the powers of life are failing, amputation may be justifiable, more particularly when the prospects of giving a useful hand or arm are small. For the arrest of diffused inflammation in the hand and arm the occlusion of the main artery of the limb has been suggested and adopted. Moore did it in the upper extremity, with enough success to justify the practice. At times bleeding is apt to take place during the progress of the sloughing of the tendon, and if recurrent such a complication is likely to induce the surgeon to perform some opera-

tive act upon the main vessel of the extremity for its control. Before doing this, however, he should always remove any sloughing tendon, for I have known hemorrhage, even of a severe kind, to be kept up by the presence of a sloughing tendon in a part, and to be arrested by its removal.

Chronic Inflammation of Tendons.—The thecæ of the tendons of the extensors of the thumb, of the tendo Achillis, the long tendon of the biceps, as of other muscles, are liable to inflame, this action being attended with pain and weakness on moving the muscles; at times some swelling will exist to indicate the presence of effusion, but more frequently the affection will be made manifest by a peculiar crackling sensation which is experienced on grasping the part when the muscles are in motion. This crepitation has been more than once mistaken for that of fracture when it has followed an injury; it is, however, distinct, and when once felt cannot well be mistaken. The affection is readily cured by rest of the affected muscles, and the application of one or more blisters. This rarely goes on to suppuration unless neglected.

CHAPTER LXXXVI.

AFFECTIONS OF BURSÆ MUCOSÆ, GANGLION, ETC.

BURSÆ are protective synovial bags; they are found in the subcutaneous tissue wherever abnormal pressure or friction has been present, as well as between tendons and bone and between muscles. As adventitious productions, they appear whenever pressure and friction combined set up local irritation, as in bunion and club-foot, and over the malleoli from the pressure of a boot. "The bursæ or ganglions which form about the sheaths of the tendons at the wrist appear to be the cystic transformations of the cells inclosed in the fringe-like processes of the synovial membrane of the sheaths. Sometimes they are distended with serous fluid; at other times their contents possess a gelatinous or even a honey-like consistency, which constitute a form of meliceris. Under some circumstances free fibro-cartilaginous-like bodies, irregularly shaped, composed of a compact connective substance, form in considerable numbers, more especially in the ganglionic enlargement of the synovial bursa which surrounds the flexor tendons of the fingers at the wrist." (Paget, "Surg. Path.")

These bursæ are liable to inflame, suppurate, and consolidate. Those but slightly connected, or unconnected with tendons, are called bursæ; those intimately associated with them ganglia.

Chronic inflammation of a bursa is a very common affection; when attacking the subcutaneous bursa over the patella or its ligament it is known as housemaid's knee; when over the elbow as the miner's elbow. Bursæ may enlarge, however, wherever there is pressure; thus, I have seen them over the acromion process in men who carry timber; over the lower part of the thigh above the tendon of the extensors in a woman who habitually started her sewing machine with the knee; over the dorsum of the foot in extreme cases of talipes equino-varus, when the child walked upon the part. Over the ball of the great toe it is a common affection under the name of "bunion;" over the instep and the toes from tight boots; and it is not unknown in Spitalfields, amongst the weavers, over the tuberosity of the ischium, as the "weaver's bottom." In most cases pressure is the cause, the disease being in a measure compensatory, to save the tissues beneath. It is

not so, however, in all, for I have seen more than one instance in which enlarged bursæ existed over the knuckles of the first phalangeal joints without any such cause.

In the very earliest stage of inflammation of any bursa—say that over the patella—pain and local crepitation on the slightest pressure are the chief symptoms. In the more advanced stage an encysted fluctuating swelling may be seen—at times tense, at others relaxed. In more chronic cases the bursa will be harder, firmer, and less distinctly fluctuating; in very neglected or chronic cases it may have consolidated, when it will appear as a solid tumor. Under these circumstances the tumor, on section, will probably contain some cavity in its centre, the mass of the tumor appearing to be made up of concentric laminæ of organized lymph (Fig. 464). In rarer cases the bursa may have completely consolidated. At times these bursæ contain simply serum; in other cases rice-like bodies (organized fibrin); in rarer examples, loose bodies or pedunculated fringe-like outgrowths, like loose cartilages; when injured they may become filled with blood—their contents being grumous or like coffee-grounds (*hæmatocele*). At times bands of lymph cross the sac, but more frequently they line it in different layers, onion-like in character. In neglected cases this fibrin may die and slough away. I have seen several of such cases where the lymph of a consolidated bursa has died and been cast out as in an ordinary cellular membranous ulcer. In syphilitic subjects this result is not unfrequent, the whole bursa, with its contents, dying and being cast off.

On the other hand, a bursa may increase by effusion, and by some external cause rupture subcutaneously or externally, and thus undergo a cure. In 1870 I had a case of the former kind under care in a man, *æt.* 60, who had a bursa over his patella, the size of a fist, which ruptured on kneeling. When I saw him the cellular tissue about the knee was infiltrated with serum, which was subsequently absorbed, and the bursa did not reappear.

TREATMENT.—In the early crepitating stage of effusion the removal of all pressure and the application of a blister are, probably, sufficient means to effect a cure. In more advanced stages also the repeated application of blisters is often sufficient to excite absorption of the fluid and recovery. When these means fail, and the walls of the bursa are thin, the cavity may be tapped and the parietes of the cyst firmly pressed together by means of a pad and strapping; when the walls are indurated this treatment is useless, and the introduction of a seton should be adopted; this should be kept in till suppuration is freely established, when a cure will generally be effected. In more solid cysts none of these means are of use; indeed, excision is then the only sound practice to be employed, the surgeon making his incision over the outer border of the bursa in order that the cicatrix may be out of harm's way.

In some few instances where tapping is applicable but ineffectual, the cyst may be injected with iodine, as in hydrocele, with advantage, twenty drops of the compound tincture in a drachm of water being enough.

When blood has been effused into the bursa from a blow, as indicated by its sudden increase, a free incision into the cyst and the evacuation of the clots may be expected to be followed by a recovery; but this should only be done when its absorption does not take place by natural processes.

There is a deep bursa beneath the deltoid muscle which is not rarely

FIG. 464.

Semisolid bursa, laid open.
(Guy's Museum.)

inflamed. Such an affection gives rise to swelling around the shoulder-joint, pain and crepitation on movement, simulating shoulder-joint mischief. At times this bursa communicates with the joint through the bicipital groove in which the biceps tendon plays. This bursa may be distended with simple fluid or with loose bodies, such as are found in other bursæ or ganglia. They are to be dealt with cautiously, on account of the possibility of their communicating with the joint. Thus, blistering and absolute rest of the arm are the best means to employ, the bursa being opened only when obstinate, and when bulging in front of the deltoid tendon over the bicipital groove exists; from one of these bursæ on two occasions I have evacuated within three months more than half a pint of bursal fluid, filled with melon-seed bodies, a recovery subsequently taking place. Such an operation should, however, be done only after grave consideration.

Another extensive bursa, situated beneath the *extensor muscles of the thigh*, is not unfrequently the seat of acute or subacute inflammation, and such cases have been mistaken for inflammation of the joint. The diagnosis ought not, however, to be difficult, for in the bursal enlargement, however great, the bulging of the cavity will seldom extend beyond the upper border of the patella; it will not, as in joint disease, extend to either side of that bone and below it.

Fluctuation, moreover, will only be felt above the joint, and not obliquely through it. When the patient stands, the difference between the distension of the bursal sac and that of the synovial will be at once manifested. With this enlargement there may be some stiffness of the joint, but always mobility. At times this bursa becomes the seat of suppuration, when the necessity of a correct diagnosis is more important on account of treatment. In all cases it is necessary to maintain rest, blisters, &c., aiding the absorption of the fluid. In obstinate cases, when the bursa is very tense, the cavity may be tapped, and when it suppurates freely opened, but neither of these operations should be undertaken without a strong necessity, for suppurative inflammation of the bursa may extend to the joint with a fatal result. I have, however, tapped such a bursa in a woman, æt. 35, and drawn off eight ounces of a thick, grumous-looking, semi-purulent fluid with success; and in a second case, in a woman, æt. 50, I made a free incision into the bursa and evacuated many ounces of pus and blood, as in a hæmatocele, a good recovery taking place.

The deep bursa between the Ligamentum Patellæ and the bone is very liable to inflame and enlarge; it gives rise to pain which is often mistaken for joint disease; this pain is, however, always local over the bursa, and is aggravated by the patient attempting to raise the extended leg, this point indicating the seat of the disease. It is a very troublesome affection, and when established it is to be only treated successfully by means of blisters and rest, with the leg on a splint.

The bursa situated over the upper part of the tuberosity of the os calcis, between the bone and the tendo Achillis, is sometimes inflamed, and gives rise to a marked projection in the part; it causes pain and lameness. It is readily cured by absolute rest, and blisters when the cure is slow. The foot and leg should always be fixed on a splint. In a case recently under care the young man, æt. 23, had bursæ over the knuckles at the first phalangeal joint of all the fingers. They had existed for years, and were about the size of haricot beans. No cause could be found for their enlargement.

The bursa in the popliteal space connected with the tendon of the semimembranosus muscle is frequently enlarged, and may from mere effusion attain a large size. At times it may even consolidate as its fellow over the patella, and appear as a solid tumor. I have seen this, however, on only

one occasion. It is to be dealt with, like other bursæ, by restraining the movement of the muscle and the application of repeated blisters; in extreme cases tapping may be performed; but the student should remember that this bursa very commonly communicates with the knee-joint, and should it do so any tapping or more active surgical treatment may be followed by the destruction of the joint. Thus, in a case which was under my care some years ago, in which by repeated blistering the tumor disappeared for a time only to recur, a surgeon was induced to tap and subsequently incise the cyst, after which acute suppuration of the part occurred, which ended in amputation.

The case of solid bursa above mentioned occurred in my own practice; I mistook it for a tumor, having punctured it with a needle without any fluid resulting. It was in a man of middle age, and had been growing for about ten years; it was the size of a fist, filling the popliteal space, solid and movable. I found that it was connected with the tendon only on making the attempt to remove it; on recognizing its nature I took away a large portion of the mass down to its central cavity, which was the size of a nut; I left the deeper part. Suppuration, however, subsequently attacked the knee-joint, for which amputation was required. I am unable to point out how a correct diagnosis is to be made in such a case as this, but the record of the fact that a solid bursa may exist in this locality and the unfortunate result which accrued upon operation in my case may be of value. Holmes draws attention to a valuable paper by M. Foucher on this subject in the "*Archives Générales de Méd.*," 1856.

A bursa also naturally exists in connection with and beneath the tendon of the psoas muscle as it passes over the arch of the pelvis; this also may communicate with the hip-joint. When distended with fluid it will give rise to a swelling in the upper part of the thigh, on the inner side of the femoral vessels; it will be soft and fluctuating, but will not receive any impulse on coughing, as a psoas abscess, for which it is apt to be mistaken.

The bursa between the tendon of the gluteus maximus and trochanter may also inflame and suppurate, and when it does, it gives rise to a troublesome and often dangerous affection. When suppuration takes place an opening may be made, and it should be a free one, but the thigh should be well fixed. When suppuration does not occur naturally the surgeon should not open the bursa, but be content to keep the limb at rest and blister the swelling.

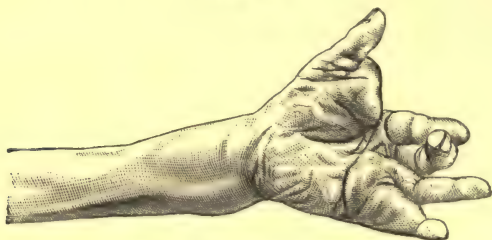
Ganglion is met with in two forms, the one, the more common, as an encysted swelling connected with the sheath of a tendon; the second, as a more diffused swelling, involving the theca of one or of many tendons, those of the wrist being the most commonly affected; the flexors being more frequently so than the extensors. I have, however, seen it in the extensors of the toes, beneath the annular ligament of the ankle; it may attack, however, any tendon. Ganglion is always the result of strain or overaction of the tendons.

The localized form of ganglion is more common on the dorsal aspect of the wrist than anywhere else, although not rarely it is connected with the flexor tendons; it appears as a globular or irregularly cystic tense swelling of the part. At times it is very hard, at others fluctuating and soft. When of good size it may be translucent. Pressure upon it to any extent causes pain, severe pressure sickening pain, even fainting and vomiting. Those in the palm of the hand, about the head of the metacarpal bones, are the most painful. At times ganglion is painless, causing only some weakness of the wrist.

A large ganglion occasionally forms behind the external malleolus connected with the peronei tendons ; it is to be touched with care.

The diffused or compound ganglion varies in its symptoms, according to the number of tendons that are involved ; when one only is affected it may appear as a deepseated, fluctuating, irregular swelling in the course of the tendon, the amount of swelling and deformity depending entirely upon its size. When many tendons are involved the swelling will be more diffused ; when the whole of the flexor tendons are implicated, both in the palm of the hand and above the wrist, in the forearm a very marked swelling will exist. In the case illustrated in Fig. 465, taken from a woman, æt. 49, sent to me by Dr. Lovegrove, of Eaton Square, all the

FIG. 465.



Ganglion involving all the flexor tendons of hand and wrist.

flexor tendons were involved to an extreme degree. In such cases as these the foreign bodies, commonly called "melon-seed" bodies, are usually present ; they may frequently be made out to exist by the surgeon when ascertaining the presence of fluctuation, and more particularly from above and below the annular ligament of the wrist ; firm pressure alternately applied in this direction generally exciting a peculiar rough scooping sensation, which is caused by these loose bodies passing along the thecæ of the tendons beneath the ligament.

TREATMENT.—The local ganglion, when first formed, may often be cured by the application of a blister and rest of the tendon, as secured by means of some splint. But when it has existed for some time such treatment is useless. When it can be ruptured by pressure applied by grasping the flexed hand with both hands and by one thumb superposed upon the other over the ganglion, a cure may often be effected ; firm pressure being subsequently kept up by means of a pad of lint and strapping. When this, however, fails, the ganglion should be punctured subcutaneously by means of a spear-shaped needle or fine tenotomy knife, its contents squeezed out, and pressure applied by lint and strapping, as before. When success does not follow this treatment a silk seton may be introduced, the hand being kept quiet on a splint. The seton should be removed as soon as suppuration has been established. This treatment should not, however, be employed until all minor means have failed, for it is at times followed by diffused inflammation of the theca of the tendon with all its dangers.

The diffused or compound ganglion is a dangerous thing to deal with ; that is, any interference with it may be followed by severe inflammation of all the thecæ involved, and limb and life be jeopardized. But this result is not common when proper precautions are taken to guard against it. The risk of such a thing should, however, always be laid before the patient by the surgeon before any operation is arranged.

The only effectual way of dealing with this affection is by incision. To do this the surgeon should, for some five or six days before, fix the hand and forearm upon a splint. He should make a clean cut into the affected theca, free enough to allow of the ready escape of all the ganglion contents, without any forcible manipulation. When many thecæ are involved more than one incision is called for, the incisions being always made in a vertical direction over the tendons, both above and below the annular ligament when the disease extends up the arm. To divide the annular ligament is never necessary. After the operation the wound should be dressed with water-dressing and the splint kept on, movement of the finger being allowed after the lapse of a few days, when the fear of diffused suppurative inflammation has passed away. In the severe example of the affection illustrated in Fig. 465, this practice was adopted with success, and in several others, of a less severe character, I could record the same result. I have never had occasion to divide the annular ligament.

CHAPTER LXXXVII.

ORTHOPÆDIC SURGERY.

WHEN paralysis takes place of a single muscle or of a group of muscles functionally associated, the opposing muscle or group, losing antagonism, acts uncontrolled, and as a consequence, contraction or deformity is liable to be produced, the deformities resulting from this class of cases being designated *paralytic distortions*.

When a muscle or a group of muscles, from whatever cause, acts spasmodically with an active tonic contraction, or a slow and progressive one, quite irrespective of the will, or but slightly influenced by it, and in this way overcomes the opposing muscle or group of muscles, deformities may likewise be produced, such cases being called *spastic or spasmodic distortions*.

In the first class the degree of deformity depends much upon the degree of paralysis that is present, and in the second class upon the amount of spasm or contracting force of the muscles involved.

Some surgeons would class all deformities in the first group, but in this they are wrong. Both classes may be congenital or acquired; in the congenital greater changes take place in the conformation of the bones than in the acquired, these changes depending much upon the intensity of the muscular action, as well as upon the period of life at which they commenced.

"It seems as if in congenital club-foot and analogous distortions a stimulus or irritant were present in the medulla spinalis, acting upon certain ganglionic cells there, which keeps the affected muscle in a state of tonic contraction, yet not sufficient to neutralize the stimulus of the will within the limits of movement permitted by the structural shortening of the member. Many non-congenital spastic contractions appear allied to the condition which prevails in some states of chorea, in which, when the will would permit or cause contraction or relaxation of a particular muscle, an involuntary influence excites contraction, interferes with, and frustrates the voluntary effort. In more intense spasmodic contractions the will is entirely overpowered before structural shortening supervenes to effect the same end." (Little.)

As an extra argument in favor of this view the fact may be adduced that club-foot often coexists with other deformities, such as spina bifida and club-hand, &c. "Congenital and non-congenital club-foot spring from analogous causes."

When these muscular contractions are powerful enough or continue long enough to so alter the natural position of a part, deformity is said to exist, and according to its seat or form has it a special name.

To Stromeyer abroad and to Little in this country are we chiefly indebted for most of our knowledge upon this subject, although in more recent times Tamplin, Lonsdale, W. Adams, Brodhurst, and others, have added much to the subject.

Stromeyer, however, in 1831 only followed Delpech in 1828, this great surgeon, following a greater one—John Hunter—who in 1794 had established the principle of subcutaneous surgery, when he divided injuries to sound parts into two divisions and established this principle that—"The injuries of the first division, in which the parts do not communicate externally, seldom inflame, while those of the second commonly both inflame and suppurate."

Club-foot may be divided into four typical forms:

Talipes equinus, in which the heel is simply drawn up by the contraction of the muscles of the calf (Fig. 466).

Talipes varus, in which the foot is drawn inwards to different degrees (Fig. 467).

Talipes valgus, in which the foot is turned out (Fig. 469).

And **talipes calcaneus**, in which the foot is drawn up and the heel depressed (Fig. 471).

Combinations of these forms are commonly seen; thus, we have *T. equino-varus*, when the foot is turned *in* and heel drawn up (Fig. 465); *T. equino-valgus*, when the foot is turned *out* and the heel drawn up; *T. calcaneo-varus* and *calcaneo-valgus* being terms applied when the heel is depressed and foot turned in or out.

Talipes varus is the usual congenital form, but any may exist, talipes equinus and equino-varus and valgus being the more common acquired forms.

In *valgus* the peronei muscles are chiefly involved; in *varus* the adductors, particularly the two tibials; in *equinus* there is contraction of the muscles of the calf through the tendo Achillis; and in *calcaneus* paralysis of the same group.

Club-foot is often hereditary, and is more prone to attack the male branches of a family than the female, and in this respect seems to follow the ordinary law of all deformities. In a case recently under my care of talipes varus the child's father, grandfather, and great grandfather, on the father's side, had congenital talipes, none of the female branches of the respective families being deformed.

"It is convenient, for practical purposes, to divide congenital club-foot into three degrees of severity: the *slightest*, that in which the position of the front of the foot, when inverted, is such that the angle formed by it with the inside of the leg is greater than a right angle, and in which the contraction is so moderate that the toes can easily be brought temporarily by the hand of the surgeon into a straight line with the leg, and the heel be depressed to a natural position. The *second* class includes those in which the inversion of the foot and elevation of the heel appear the same or little greater than in those of the first class, but in which no reasonable effort of the surgeon's hand will temporarily extinguish the contraction and deformity. The *third* class comprises those in which the contraction of the soft

parts and displacement of hard parts reaches the highest degree, so that the inner margin of the foot is situated at an acute angle with the inside of the leg, sometimes, or even almost in contact with it. Cases of the first and second grades may be respectively converted into the second and third grades by delay in the application of remedies, and by the effects of improper locomotion." (Little.)

Talipes equinus is the most common form of the acquired talipes, although Little positively declares it is at times congenital; it is found in every degree, from the inability to flex the foot beyond a right angle to a pointing of the toes, necessitating the patient walking upon the heads of the metatarsal bones and phalanges, the head of the astragalus projecting prominently on the dorsum of the foot. Fig. 466 illustrates the medium and extreme forms.

Talipes varus is the more common congenital form. Fig. 467 illustrates it in three degrees of severity.

It is very frequently, however, combined with *T. equinus*, as seen in Fig. 468. The arrows in the figure indicate the direction of the convexity of the tarsus and metatarsus forwards and outwards; the perpendicular line through the axis of the limb shows the extent of the inward deviation of

FIG. 466.

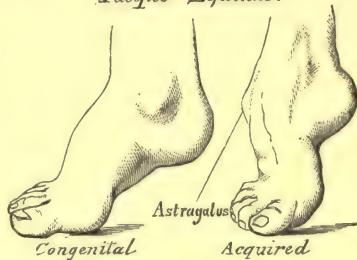
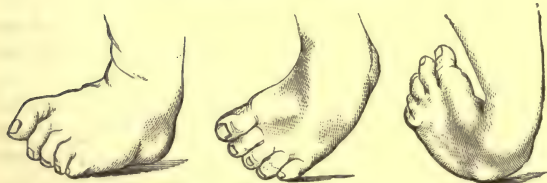
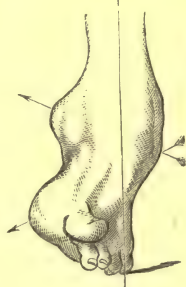
Talipes Equinus.

FIG. 467.

Congenital Varus.

Three grades of severity.

FIG. 468.

Equino-Varus

From Little.

the metatarsus, by which the base of the little toe, being brought completely beneath the axis, has to support the entire weight of the body in walking.

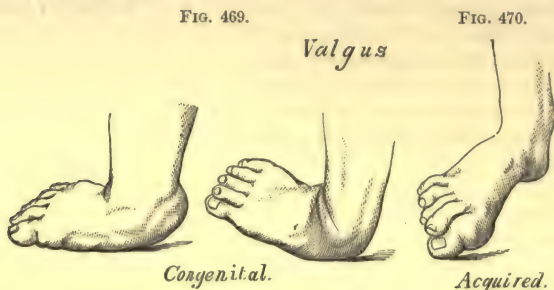
Talipes valgus may be congenital or acquired, and of all degrees of severity; the two forms present very different appearances. Fig. 469 illustrates the congenital form in two degrees of severity; and Fig. 470 the acquired.

Talipes calcaneus is illustrated in Fig. 471.

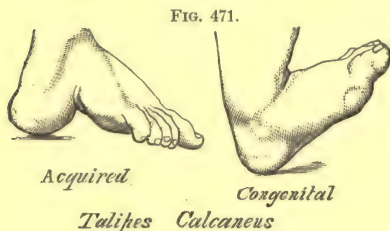
For a full detail of the anatomical changes of the foot under these different conditions, *vide* Adams in "Path. Soc. Trans.," vol. iii.

Before passing on to the treatment of these affections it will be well to consider, however briefly, the principle upon which all interference must be based, and the process by which repair takes place after the division of tendons.

To Paget and W. Adams, in this country, we are chiefly indebted for our knowledge upon this subject, and I shall use, as much as possible, Adams's



description of this process, as published in 1860 in his work on the "Reparative Process of Human Tendons after Division," his investigations having confirmed those of Paget, and added to our stock of knowledge.



When a tendon is divided subcutaneously, such as the tendo Achillis, the divided ends separate—in an infant for half an inch, and in an adult from one to two inches, the degree depending much upon the healthy condition of the divided muscle and the amount of movement subsequently permitted in the ankle-joint.

The reparative process begins by increased vascularity in the sheath of the tendon, and this is followed by infiltration of a blastematous material into its meshes or spaces between its fibrous elements; this material exhibits the development of innumerable small nuclei, a few cells of large size and irregular form, with granular contents, or, perhaps, with one or more nuclei, and studded with minute molecules of oil; but a blastematous material, in which the cell forms do not pass in development beyond the stage of nuclei, appears to be the proper reparative material from which new tendon is developed. This nucleated blastema soon becomes vascular, capillary vessels having been seen in it on the eighteenth day; the nuclei assume an elongated, spindle, or oat-shaped form, and are seen, after the addition of acetic acid, to be arranged in parallel linear series. The tissue becomes gradually more fibrillated, and at last fibrous, a solid bond of union subsequently forming between the divided extremities of the tendon. This is tough to the touch, but to the eye presents, even for at least three years, a grayish, translucent appearance, which distinguishes it at once from the glistening old tendon. This new tissue remains during life as a permanent one, and has little tendency to contract subsequently.

Adams tells us also that the divided extremities of the old tendon take no active part in the reparative process during its earlier stages, although at the later the cut ends become rounded and their structure softened; they become enlarged and exhibit a tendency to split, and thin streaks of new material, similar to that already described, are seen between the fibres; by these means the ends are joined. At a later period the bulbous enlargement gradually diminishes.

When a tendon is divided a second time there is but little separation of

its ends, and this is probably due to adhesion of the new tendon to the neighboring fibro-cellular tissue.

There is no reason for believing that in the treatment of deformities by tenotomy direct approximation and reunion of the divided extremities of the tendon must be first obtained, and that the required elongation is afterwards to be procured by gradual mechanical extension of the new connecting medium, as we would stretch a piece of india-rubber; Adams's observations lead him rather to the conclusion that the required length of new tendon is to be obtained during a lengthened period of formation, that is, about two to three weeks, under the ordinary conditions of health; but in paralytic cases, and in others of feeble health, this period may be doubled.

Gradual mechanical extension is required, therefore, in cases of *long standing*, as in those of *congenital* origin, to forcibly overcome ligamentous resistance, and to separate the ends of the divided tendons; as it is in those of *paralytic* and of *non-congenital* origin to prevent the too rapid separation of the extremities of the tendon. The mechanical extension is to be carefully regulated according to the activity of the reparative process, as indicated by the amount of effusion into the sheath. Blood poured out into the sheath and any inflammatory action interfere much with the process of repair; any causes of general feebleness, coldness of the limb, too early, too late, or too forcible extension, having a like effect. With these remarks the operation itself may be considered.

TREATMENT.—“The indications,” writes Little, “are to overcome the shortening of the muscles, ligaments, fasciæ, and integuments on the *contracted side* of the member, to direct the bones into their proper position, to educate the patient's voluntary use of the parts, to give strength to the muscles and ligaments in the *elongated side* of the member, and to combat the tendency to relapse.”

To fulfil the first indications, mechanical means are often sufficient; and when these fail, or are inapplicable, the division of the contracted structures is called for. To carry out the other, mechanical means are also of value, aided by general measures, and more particularly by galvanism of the weakened muscles. In a large number of cases, however, instruments are not required, and much less tenotomy; for in any case of congenital or infantile talipes, when the foot can be brought into the normal position by but little force, a cure can with some confidence be promised without any operation.

In the very simplest cases mere friction of the affected limb, and the daily extension of the contracted tendons—the nurse or parent holding the crooked foot for some ten or fifteen minutes, two or three times a day, in the required position—is often enough to effect a cure.

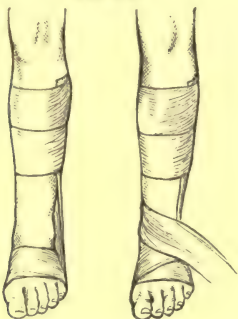
In the next class of cases, which are slightly worse than the last, in which the foot can be brought with gentle force into its natural place, a cure can be effected by means of strapping adjusted in the fashion depicted in Fig. 472, p. 918; the strapping must be of a firm nature; that spread on linen, as made by Messrs. Gerrard & Co., and used at Guy's, being the best. The first piece acts as a kind of splint, and the second, by binding down the first to the ankle, admits of any amount of force required to bring the foot in or out, according to the nature of the case. In a still more severe form, where the former method is inapplicable, a small tin splint covered with leather, with a screw hinge at the ankle, such as that advised by Little, or made for myself by Millikin, of St. Thomas's Street, may be employed, the foot being forcibly brought into the required position, and fixed there by strapping (Fig. 473).

In the worst forms, where by no ordinary force the foot can be brought

into the required position, the division of the shortened tendon or tendons or fascia is to be performed, no more structures being divided than are absolutely essential.

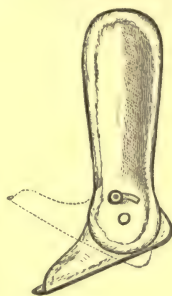
"When deciding on the necessity of operation, the surgeon must not be guided solely by the external configuration, but by the amount of firm resistance opposed to restoration, by the depth of the furrows existing in the

FIG. 472.



Mode of stretching foot in talipes varus by strapping.

FIG. 473.



Splint for talipes.

sole, and behind and above the heel, and by the degree of tension of the integuments about the internal malleolus. The deep clefts or furrows in question denote intensity of contraction of muscles, and closer adhesion than usual of integuments and fascia to the subjacent soft structures and bones. They probably denote, also, that the deformity dates from an early period of uterine existence." (Little.)

In all cases treatment should be commenced as soon as possible. The foot of the youngest infant may be dealt with with advantage a few days after birth by manual extension, and within a week extension by strapping may be carefully employed, the foot being looked to daily, to see that no sloughing or cutting of the skin by the strapping takes place, for in infants the tendons yield far more readily than they do as months or years go on, and with care no harm can accrue from simple mechanical extension. Even splints, carefully applied, can be used.

As to tenotomy, there is no reason, in a healthy, well-developed babe, why it should not be performed within the month, when it is clearly a necessity, that is, in grave deformities. I have divided the tendo Achillis in one case at the end of the first week for a talipes varus, with an excellent result, and Mr. Stromeyer Little has operated successfully within twenty-four hours.

The Operation.—In a large number of cases of congenital varus the division of the tendo Achillis is enough, the foot, after its division, generally being capable of restoration to the required position by mechanical means. In severe examples the anterior or posterior tibials, singly or together, may require to be cut. In average cases these three tendons may be divided at one operation, although in severe ones Little's advice to deal with the tibial tendons first, and overcome the inversion of the foot, and at a later date divide the tendo Achillis, is a good one. The value of this proceeding, Little says, consists in the fixed os calcis offering a resisting point, from which the surgeon is enabled to stretch out and unfold the contracted involution sole.

Division of the Tendo Achillis.—The patient should be turned over on to the abdomen, and the tendon made tense by means of an assistant. The surgeon should then insert a sharp-pointed knife from behind forwards by the side of the tendon, as far as its anterior surface, when it should be turned laterally in front of the tendon, and its cutting edge directed backwards towards the tendon, when with the slightest sawing motion the tense cord may be divided. The surgeon should, during this procedure, keep his finger upon the tissue to be divided, and immediately on the withdrawal of his knife close the opening with his finger or thumb, the assistant, at the moment he feels resistance cease, relaxing the parts. A dossil of lint is then to be applied to the puncture, and fixed by strapping. This dressing to be left for three days. Should any suspicion exist of any wound of the posterior tibial artery having been sustained, as indicated by arterial hemorrhage and blanching of the foot, the dressing should be left on for at least a fortnight, and all mechanical treatment postponed. It is, however, an exceptional circumstance for any harm to follow the puncture of the artery. Little, with all his experience, says he has only once seen any trouble from the circumstance.

After the operation the foot should be bound to a flexible metal splint, in its deformed position, till some uniting medium has formed in the tendon, after which the mechanical treatment may be commenced.

Division of the posterior tibial tendon should be performed with the child upon its back, with the limb to be operated upon rotated well outwards. The surgeon should take charge of the foot, and an assistant of the knee, and the tendon should be divided about one inch, or one and a half inch, above the extremity of the inner malleolus. In thin subjects, on abducting the foot, the tendon may be felt at the spot indicated; but in fat ones, and when the tendon cannot be made out, the surgeon knows it lies along the inner edge of the tibia, "exactly midway between the anterior and posterior borders of the leg on its inner aspect."

At this spot the knife is to be inserted perpendicular to the surface through the fascia for about half an inch, this opening in the fascia being made sufficiently free to admit of the introduction of the probe-pointed knife, which is next to be inserted. This knife is then to be introduced perpendicularly, close to the bone, and between it and the tendon to be divided, when its edge is to be turned towards the tendon, and the operation completed by a slight sawing movement. It is not always necessary to change knives during this operation, some operators, indeed, never doing so; it is safer, however, to adopt the practice in fat subjects when some uncertainty exists as to the exact position of the tendon. As soon as the tendon has been divided, a dossil of lint is to be applied, as in the former operation.

Some surgeons prefer to divide the tendon of the long flexor muscle at the same time; this, however, is not, as a rule, necessary.

Division of the anterior tibial tendon is to be performed with the patient on his back and the foot extended, the tendon being in this way made prominent in front of the inner malleolus. The knife should be inserted at this point behind the tendon, and its edge turned forwards, when the tight cord can be at once divided, the foot being at once flexed, and the punctured wound covered with lint and strapping. It is to be kept in a splint for several days, as after division of the tendo Achillis.

When all these tendons are divided at the same operation the after-treatment is to be the same.

Division of the peronei tendons for talipes valgus is easily accomplished by adducting the foot and the introduction of the knife behind the exter-

nal malleolus, between the tendons and the fibula, the tendons being cut on turning the edge of the knife towards them with a sawing movement. Some surgeons advocate a higher division of these tendons to obviate their retraction, union taking place between the tendon and the sheath.

It is unnecessary to describe the operation for division of the *plantar fascia* or other tendons; the practice in all is to be conducted on principles identical with those already described.

MECHANICAL TREATMENT.—However necessary the operation already described may be, in any given case, it must be remembered they are only preparatory to the mechanical treatment of stretching which is subsequently to be carried out; that they are not always necessary has already been shown, mechanical treatment being at times amply sufficient of itself to effect all the surgeon wants.

In one case, after the division of the rigid tendon or tendons, a cure may be effected by means of strapping, as already illustrated (Fig. 472); in a second a simple inside or outside splint, with strapping or bandages, may be enough. In a third example the simple splint figured in Fig. 473 answers every purpose; while in a fourth Scarpa's shoe, or some of its modifications, is required. (Fig. 474.)

In all, the principle embodied is the same, the stretching of the tendon, the separation of its divided ends, and the deposition of new material between them. In all cases the splint is to be applied and fixed to the foot in its deformed position, and the stretching process commenced on the third or fourth day; it ought also to be completed by the third or fourth week. Delay in this matter, as a rule, means failure, for the new tissues soon assume a fibrous character, and the deposition of new material takes place only during the early days, after the operation. In adults, however, the mechanical treatment may extend over many months.

Should failure follow the first operation, a second may be performed, but the hope of a successful issue, under these circumstances, is far from good. In a general way, however, mechanical means will do all that is required.

Barwell has recently revived the old practice of elastic bands to stretch the tendons in lieu of their division, and in some cases it is a valuable practice, but as a substitute for tenotomy it is not to be recommended.

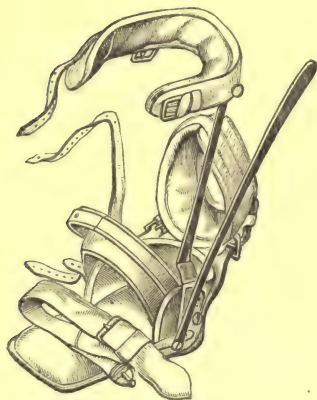
FIG. 475.

*Spurious Valgus*

Spurious Valgus, or Flat-foot.—This requires a notice, for it is a common condition and causes much distress; it is found in growing boys and girls who stand much or take too much exercise, and it is the direct result of the giving way or yielding of the ligamentous and fibrous structures of the sole of the foot (Fig. 475), the arch of the foot sinking, the foot and toes everting, and the peronei muscles contracting as a secondary consequence. In extreme cases the movements of the ankle-joint are seriously interfered with.

When only slight, it can readily be remedied by simply giving rest to the

FIG. 474.



Little's shoe for talipes.

weakened tissues, by forbidding standing, and allowing only gentle exercises, and by the use of tonics, &c., during the growing period of life. Mechanical support, by means of strapping, at other times gives great comfort and does good.

In a worse class the introduction of a light steel plate, in the hollow of the boot, is of great use as a support.

It is only in very neglected cases that tenotomy can be called for, and this not as a curative means.

In examples in which much pain exists nothing but absolute rest will be of any use; in such the local signs of inflammation of the over-stretched parts are often to be read, when fomentations, &c., may be employed.

Knock-knee, like flat-foot, is due to the mechanical yielding of the ligaments of the knee-joint from want of power. It is found in growing boys and girls who stand too much or carry heavy weights, and in those of feeble power, either from natural or acquired causes. It is not rarely seen with rachitis.

It is to be treated on principles based upon the facts just briefly stated, and not purely by mechanical means. To put irons on the limb of a feeble subject is a mistake, for where the child is too weak to support his own frame without injury, to give him more to carry must be injurious. Young children should be taken off their legs as much as possible and provided with proper food, and such tonic medicines as seem requisite. The weakened ligaments should have time given them to contract and become strong. Older children should be limited in the amount of exercise; rest and exercise should be made to alternate at regulated intervals. When walking half an hour causes pain or aching, something less should be allowed, and so on. Exercise sufficient to get and keep the muscles in order may be allowed, but not sufficient to tell upon the weakened ligaments. In other cases strapping the knees may be of great use as an additional means; in extreme cases only should splints or irons be employed. These latter instruments, when used, should extend from the pelvis to the foot, and be well jointed. Double splints are of little use in these cases; in the simple they are not wanted, in the severe they are useless. When the knees give out instead of in, from the same cause, the same principles of practice are applicable. Besides all these recognized affections there are many other conditions in which tenotomy is a valuable operation. Thus, in the contracted limbs which are associated with hip, knee, or other joint disease, it is often necessary to divide the rigid and contracted tendons or muscles that forbid the limb being straightened by the application of any ordinary or justifiable force; mechanical means can then complete the object the surgeon has in view. It is better to divide a tendon than to tear it.

Contractions of the Fingers.—In this affection, where the flexor tendons and the palmar fascia together produce a permanent contraction of first one and then the other finger, so as to draw them into the palm, some operation is called for.

This affection is a curious one; it generally appears in the little finger, and subsequently involves the ring finger; often it attacks both hands, together or consecutively. It is said to be found more frequently in gouty or rheumatic subjects than in others, but I have failed to find out this fact. It is difficult also to trace the origin of the disease to any local injury; in fact, this affection is somewhat obscure. It may attack the middle finger or any or all of the fingers, but it is more commonly in the two outer. From its symmetry it has probably a constitutional origin, and not a local one; it is often hereditary, but possibly not more so than any other deformity.

TREATMENT.—By fixing the contracting fingers in a flexible splint, and gradually stretching them, much may be done, and in several cases I have by these means effected a complete cure. But it is difficult to get men patients to submit to this inconvenience, and, as a consequence, the surgeon is only consulted when the disease is severe and the finger by its contraction has become useless, if not worse than useless. Under these circumstances the free division subcutaneously of all the tense tissues may be called for, in the same way as other tendons are to be divided, mechanical treatment being commenced on the third day. In the same way one or more toes may be so affected, for which tenotomy may be called for.

Not long ago I saw a boy, *æt.* 14, who for years had had repeated attacks of pain and inflammation about his great toe, more particularly after over-walking. He had been under the care of many medical men, who had treated him for gout, &c., &c., but who had never compared the sound with the affected toe. When I did this the source of the evil was very apparent, for the long extensor tendon was clearly contracted, and at its insertion into the base of the extreme phalanx there was much thickening. I divided the tendon, and recovery at once ensued.

The biceps muscle of the arm is also at times so contracted as to prevent extension, and tenotomy may be called for. In fact, any tendon may, under the influence of disease, contract, and require division.

Rigid Atrophy.—Muscles that atrophy at times contract and become rigid, but this rigidity must not be mistaken for the spasmodic contraction of a muscle or group of muscles that is so common in progressive disease, more particularly of joint disease, although it often follows upon that form; indeed, it seems generally to be the consequence of some long-continued spasm, atrophy following from exhaustion, inflammation of the muscle, or what is called rheumatism. It is seen more commonly in the flexor muscles of joints than in any other, and as a special affection in some cases of *wry-neck*, when the sterno-mastoid muscle is at fault.

TREATMENT.—When the muscles are not too rigid much may be done by rapid extension, under the influence of chloroform, or gradual by means of splints, manipulation, or india-rubber bands, &c., suited to the wants of the individual case. When these means are ineffectual, or the parts are too rigid to allow of their application, the subcutaneous division of the tendon of the muscle or muscles may be performed, upon the same principle as tenotomy is practiced in contracted tendons.

Wryneck is an example of this affection, due to a contracted sterno-mastoid muscle; it may be that the sternal or clavicular end may be alone at fault, it being exceptional to find both divisions of the muscle affected. Under such circumstances, when the muscle refuses to be stretched by mechanical appliances, the half involved alone requires division, and subsequent extension when union has taken place. In these difficult cases it seems wise, as a rule, not to bring the divided ends of the muscle so closely into contact as the surgeon usually does after division of a tendon.

In the worst case of the kind I ever had to treat, in a child, *æt.* 7, in which both insertions of the muscle required division, I brought the head up to the required position on the second day, and kept it there, an excellent result ensuing; and in another, in a child, *æt.* 6, that I saw with Mr. Duke, of Battle, in which the muscle of the left side was two inches shorter than that of the right from contraction of its sternal half, I applied extension on the third day, after the division of the contracted portion, and brought the head into its right place, keeping up the extension by means of a piece of india-rubber band an inch wide, which was fastened to a skull-

cap on the opposite side of the head and passed backwards across the shoulders and beneath the axilla of the affected side to fasten to a good thoracic belt (Fig. 476).

I need hardly say that where wryneck is due to spinal disease no such treatment as the above is applicable.

These cases of wryneck, due to contraction of muscles, are always associated with some arrest of growth in the upper and lower jaws on the affected side.

Mr. De Morgan tells us ("Med.-Chir. Rev.," 1866) that in a case that failed to yield under such treatment he took away a piece of the spinal accessory nerve with permanent benefit, the sterno-mastoid and trapezius muscles being of necessity paralyzed.

The operation of dividing the sterno-mastoid muscle, either wholly or in part, at its sternal or clavicular origin, must be a subcutaneous one, and it requires much care, for important parts lie behind it, and may be injured. A punctured wound is to be made over the part to be divided with a sharp-pointed tenotomy knife down to the muscle; a blunt-pointed knife is then introduced with its edge turned towards the muscle close to its bony attachment, and all resisting fibres divided by turning the edge backwards, an assistant putting the muscle fully on the stretch; the muscle usually gives way with a distinct snap. The thumb or finger is then to be applied to the part, and a pad adjusted, sufficient pressure being made to prevent bleeding, but no more. As already stated, extension should be made early in the case, after the second or third day, and the means adopted in the example quoted seems to be the best; at any rate, it succeeded where the usual instruments failed.

When both insertions require division it should be effected by two different punctures. Some surgeons prefer to divide the muscle from behind forward, but there is greater risk of injuring the deep parts by this practice than by the one advised.

FIG. 476.



CHAPTER LXXXVIII.

ANÆSTHETICS.

WHEN Sir H. Davy's attention was drawn in 1798 to Priestley's nitrous oxide gas by Dr. Mitchell's theory that this gas "was the principle of contagion, and was capable of producing the most terrible effects when respired by animals in the minutest quantities, or even when applied to the skin or muscular fibre," and with Southey, the then Laureate, and Coleridge, the philosopher, inhaled it with sufficient frequency "to establish the fact that the gas possesses an intoxicating quality, to which the enthusiasm of persons submitting to its operation has imparted a character of extravagance wholly inconsistent with truth" ("Life of Davy," by Paris, 1831), he little thought that he was then laying the basis of experimental investigations that were to form an epoch in the history of the world, or rather of man-

kind, and to end in the introduction into practice of a new power, which, if of inestimable value to the general public, is of nearly equal value to the medical profession, and has been the means of revolutionizing surgery to an extent of which few men are aware. The "most terrible effects" with which this gas was credited having been transformed into the beneficent effects brought about by anæsthetics.

In the present work I have neither space nor inclination to go fully into the history of the subject. To the works of Snow, Sir James Simpson, Sansom, Druitt, Holmes, MM. Perrin and Lallemand, I must refer the reader for full particulars upon this point. I shall content myself by recording the fact that "the honor of the first public and authentic trial of surgical anæsthesia, by the aid of means newly discovered, belongs entirely to an obscure dentist, Horace Wells, of Hartford, Connecticut" (M. Perrin), this dentist having employed in 1844 Davy's nitrous oxide gas in dentistry with an excellent result. In 1846 Morton, Wells's late partner, introduced into practice at Massachusetts Hospital the use of sulphuric ether, probably on the suggestion of Dr. Jackson. In 1847 our own Lawrence, at St. Bartholomew's, used chloric ether for the same purpose ("Holmes's Syst.," vol. v, Ed. 2), and in the autumn of the same year Dr. Simpson gave to the profession the active principle of the chloric ether, the chloroform, on the suggestion of Mr. Waldie, of Liverpool, and since then this drug has been freely used in England and on the Continent, the Americans having still a preference for ether.

In recent times other anæsthetics have been introduced, the bichloride of methylene being the most popular.

How anæsthetics act upon the body is not yet determined, although it is tolerably certain that the ultimate result is absolute paralysis of the nerve centres, cerebral and spinal. To this end a patient passes through, first, a stage of cerebral excitement; next, cerebral insensibility and loss of sensation; thirdly, loss of voluntary motion; and, lastly, of reflex action, the brain losing its power before the spinal cord; absolute paralysis and anæsthesia only exist when both nerve centres are completely under the influence of the inhaled drug, the nerve supply of the respiratory and circulatory systems alone excepted.

Indeed, it is upon this fact that the practical value of all anæsthetics is based, the surgeon wanting to produce paralysis of the muscles of the trunk and extremities only, and not those of the respiratory or circulatory systems. In a general way there is a wide interval between the two stages; in exceptional instances this interval is abridged; in such the heart and respiratory system suddenly become affected, and it is under these circumstances that sudden death takes place.

Chloroform, like many other drugs, acts differently on different individuals, some being very susceptible to its influence whilst others are the reverse. Chloroform, like all anæsthetics, at first increases the force of the heart's action, although this effect is slight and transient, the heart acting with less than its natural force when complete anæsthesia is produced. When a patient is brought quickly under the influence of an anæsthetic the heart's action may be suddenly arrested, Brown-Séquard believing that under such circumstances "it is by the reflex influence due to the sudden irritation of the branches of the par vagum in the lungs that chloroform has killed in the very rare cases in which the heart's action has been stopped before the respiration." ("Lect. on Phys. of Nerv. System.")

Moderate doses of chloroform tend to weaken the heart's action after their first stimulating effects have passed away, the respiratory act usually

ceasing before the circulatory when death is the result. Thus danger increases with the degree of stupor produced.

Ether is said not to depress the action of the heart to the same extent as chloroform; it is, however, slower in its action, less certain in its effects, and far more disagreeable and irritating in its inhalation.

When the upper eyelid can be raised without muscular resistance, and no muscular contraction is caused by touching the cornea, the patient is as a rule sufficiently under the influence of the anæsthetic for surgical purposes.

Respiration generally, but not invariably, ceases before the action of the heart, and death is due both to the failure of the heart's action and to that of the respiratory function.

After death all the cavities of the heart are distended, and the cases are only exceptional in which the left side is empty. Chloroform may also be distilled from the blood and lung tissues. Chloroform is more commonly fatal in the struggling stage than any other.

Billroth asserts "that during the stage of excitement violent muscular efforts may give rise to apoplexy, especially in individuals with disease of the heart, rigid arteries, or emphysema. Of most consequence in this stage, however, are the contractions of the muscles of mastication and the posterior muscles of the tongue. By means of the stylo-glossi and the glosso-pharyngei the tongue is drawn spasmodically backwards, pressing the epiglottis down so as to mechanically close the aperture of the larynx. Such patients become blue in the face, and die suffocated, not through the direct action of the chloroform, but from the mechanical privation of air;" unless the tongue be well drawn forward.

Anæsthetics affect the brain of different people in as many ways as drunkenness. One will be quarrelsome, a second violent, a third sentimental, and others maudlin, melancholic, or merry.

In epileptic subjects I have seen patients pass through some epileptic convulsions during their progress towards narcosis.

The best rules for the administration of chloroform or any anæsthetic are those given by the Chloroform Committee of the Med.-Chir. Soc., 1864. It was my privilege to be one of the members of that body, and all my subsequent experience has convinced me of the value of the suggestions then laid down. I quote them in full.

Rules Relating to the Administration of Chloroform.—Chloroform should on no account be given carelessly, or by the inexperienced; and, when complete insensibility is desired, the attention of its administrator should be exclusively confined to the duty he has undertaken.

Under no circumstances is it desirable for a person to give chloroform to himself.

It is not advisable to give an anæsthetic after a long fast, or soon after a meal, the best time for its administration being three or four hours after food has been taken.

If the patient is much depressed there is no objection to his taking a small quantity of brandy, wine, or ammonia, before commencing the inhalation.

Provision for the free admission of air during the patient's narcotism is absolutely necessary.

The recumbent position of the patient is preferable; the prone position is inconvenient to the administrator, but entails no extra danger. In the erect or sitting posture there is danger from syncope. Sudden elevation or turning of the body should be avoided.

An apparatus is not essential to safety if due care be taken in giving the

anæsthetic. Free admixture of air with the anæsthetic is of the first importance; and, guaranteeing this, any apparatus may be employed. If lint, or a handkerchief, or a napkin, is used, it should be folded as an open cone, or held an inch or an inch and a half from the face.

Chloroform should invariably be given slowly. Sudden increase of the strength of the anæsthetic is most dangerous. Three and a half per cent. is the average amount, and $4\frac{1}{2}$ per cent., with $95\frac{1}{2}$ of atmospheric air, is the maximum of the anæsthetic which can be required; given cautiously at first, the quantity within this limit should be slowly increased according to the necessities of the case, the administrator being guided more by its effect on the patient than by the amount exhibited.

The administrator should watch the respiration of his patient, and must keep one hand free for careful observation of the pulse.

The patient who appears likely to vomit whilst beginning to inhale the anæsthetic must be at once brought fully under its influence, and the tendency to sickness will then cease.

The occurrence, during the administration of an anæsthetic, of sudden pallor, or of sudden lividity of the patient's countenance, or sudden failure or flickering of the pulse, or feeble or shallow respirations, indicates danger, and necessitates immediate withdrawal of the anæsthetic until such symptoms have disappeared.

On the occurrence of these symptoms, and especially if they should become so urgent as to threaten death from failure of respiration, of the heart's action, or of both together, the following rules of treatment are to be observed:

Allow free access of fresh air, pull forward the tongue and clear the mouth and fauces, keep or place the patient recumbent, dash cold water on the face and chest, and aid the respiratory movements by rhythmical compression of the thorax.

In the more threatening cases commence instantly with artificial respiration, whether the respiration has failed alone or the pulse and the respiration together.

Galvanism may be used in addition to artificial respiration, but the artificial respiration is on no account to be delayed or suspended in order that galvanism may be tried.

Few, if any, persons are insusceptible of the influence of chloroform, from two to ten minutes being required to induce anæsthesia. The time, however, varies with age, temperament, and habits.

The mixture of alcohol 1 part, chloroform 2 parts, and ether 3 parts, should be given in the same way as chloroform alone, care being taken, when lint or a handkerchief is used, to prevent the too free escape of the vapor. I think highly of this mixture.

Use of Chloroform in Surgical Operations.—With heart disease the anæsthetic may be given in any case which requires an operation, although when there is evidence of a fatty, weak, or dilated heart great caution is demanded. Valvular disease is of less importance.

In phthisis, when an operation is unavoidable, anæsthetics may be given with impunity.

For all operations upon the jaws and teeth, the lips, cheeks, and tongue, anæsthetics may be inhaled with ordinary safety. By care and good management the patient may be kept under their influence to the completion of the operation. In these cases blood, as it escapes, if not voided by the mouth, passes into the pharynx. If any small quantity finds its way through the larynx, it is readily expelled by coughing. In operations upon the soft palate, fauces, pharynx, and posterior nares, if sudden or severe

hemorrhage is likely to occur, it is not advisable to induce deep insensibility. In cases requiring laryngotomy and tracheotomy anæsthetics may be employed with safety and advantage.

For operations upon the eye, involving the contents of the globe, the use of anæsthetics is open to objection, on account of the damage which the eye may sustain from muscular straining or vomiting. If employed, profound insensibility should be induced. Recent experience tends rather to prove that anæsthetics may be used without fear in most eye operations. Mr. Bader, at Guy's, employs the bichloride of methylene without hesitation in all cases.

In operations for hernia, and in the application of the taxis, anæsthetics act most beneficially. For most operations about the anus profound anæsthesia is positively demanded.

In the condition of shock or of great depression, as after hemorrhage, the careful administration of anæsthetics diminishes the risk of an operation.

In all cases other than those specially referred to it is sufficient to state, so far as a mere surgical operation is concerned, anæsthetics may invariably be administered.

The continuous vomiting occasionally induced by and following upon the inhalation of anæsthetics may be injurious by consequent exhaustion, as well as by mechanically disturbing the repair of a wound. With this reservation, they do not appear to interfere with the recovery of patients from surgical operations.

Statistics.—The results of 2586 capital operations performed before, and of 1847 performed since, the introduction of anæsthetics, which I collected from all authentic available sources, show that anæsthetics have in no degree increased the rate of mortality.

The risk attending the inhalation of chloroform is very small; it is about 1 in 3000. This is enough to forbid its use in trivial cases, but not enough to do so in cases of capital operation, or where for purposes of diagnosis it is required. In children it is very safe.

The best common instrument for its administration is the one employed at Guy's, which I introduced in 1864, having had it made after a pattern suggested by Dr. Parker, late of the London Hospital. It is not complicated by any valves; it is merely a mouth and nose piece lined with lint, with openings to admit air freely (Fig. 477).

Clover's apparatus is, however, by far the best when it can be obtained; it is composed of an india-rubber bag, into which chloroform or any other anæsthetic is pumped, mixed with atmospheric air. Clover employs 3 or 4 per cent. of chloroform. It is, however, a cumbersome apparatus, and cannot be at universal command.

The bichloride of methylene is recommended to our notice as an anæsthetic of great power. Patients are said to be brought under the influence of the drug in twenty or thirty seconds of time, and to recover from it rapidly with little inconvenience. No sickness or headache is said by Mr. Rendle to follow its use, unless the inhalation have been continued for many minutes, or a second dose is given to keep up the effect. Of course, if the inhalation be prolonged, the after-effects resemble, though in a less degree, those of chloroform, save the one—absence of muscular excitement.

"The rapidity of action of the drug and recovery appears," adds Rendle, "to be due to its great volatility and solubility, enabling a large quantity

FIG. 477.



Chloroform inhaler.

to reach and escape from the nerve organs at once; its safety, to its rather stimulant action on the heart, and its rapid elimination. The bichloride, being very volatile, requires to be kept in a well-stoppered bottle; and it is an advantage to keep it in the dark, inverted, under water."

Mr. Rendle claims for its use the following advantages: The patients retain their normal color and appearance; the anæsthesia is good, is rapidly induced, and can be maintained for any length of time; the recovery is rapid and complete; there are no unpleasant after-symptoms nor muscular rigidity. He says it is also at least as safe as chloroform. At Guy's Hospital it is in common use for eye surgery, where a few minutes are alone required for the anæsthesia, but in the wards generally chloroform is the favored drug.

In abdominal surgery, such as ovariectomy, Keith has said that ether is less prone to be followed by sickness than chloroform, and, if the success of an operation is any argument in its favor, Keith's success must be quoted. I have for some years employed the mixture of the Chloroform Committee, of alcohol, chloroform, and ether—and think well of it. I believe it to be as good as chloroform, and that it is less likely than any other to be followed by that bane of all anæsthetics, vomiting.

In the operations of dentistry and all short measures the nitrous oxide gas seems of great value.

After the use of any anæsthetic everything should be given cold for twelve or twenty-four hours to prevent sickness; ice, indeed, may be sucked with advantage; ice and milk is a very favorite mixture. If hot things be given, vomiting is far more likely to appear or to be aggravated.

Anæsthetics, however, have other uses than the destruction of pain; as aids to diagnosis they are of priceless value both to the physician and surgeon. To the surgeon they have also opened up new fields for his scientific art that were formerly but little known. I shall point them out, however, but briefly, quoting from a lecture I had the honor of giving at the Hunterian Society in 1870:

"Chloroform as an aid to diagnosis stands second to no means which we have at our disposal. To the physician who has a difficult case of abdominal tumor to diagnose, what facilities it gives him for its thorough investigation! Suspected tumors become phantoms; movable kidneys fly away; and indefinite conditions become clear and intelligible. With how much greater certainty a physician can think over a doubtful case, decide upon its nature, deliver his opinion, and treat the case when he has adopted this means of investigation. In hysterical subjects, it renders a thorough abdominal examination a possibility, when no such previously existed; and in what class of cases, may I ask, is it more necessary to make a positive diagnosis than in this? In my own practice, it enabled me on one occasion to make out a pregnancy when an ovarian tumor had been diagnosed by men whose authority was undoubted, and in a patient whose position in life rendered the suspicion of pregnancy almost a libel. Indeed, the ovarian nature of the disease was looked upon as so decided, that my aid was sought solely for the operation. In this case an examination of the abdomen was impossible, from hysterical sensibility; but, under chloroform, all difficulties disappeared. To the physician-accoucheur may I not also assert it to be equally valuable for diagnostic purposes? To answer this fully is out of my province; but I have known a case of cystic disease of the uterus, which was about to be operated upon as an ovarian tumor, made out by the use of the uterine sound, with the patient under chloroform, when an examination by the same instrument made before had failed to yield any such evidence. In the surgical diseases of children is it

possible to over-estimate its value? With what gentleness can difficult examinations be now made of injured limbs; and with what certainty can we now apply our treatment! In sounding for stone, what facilities it affords! In general surgery, what new fields has it not opened? Where would ovariectomy have now been, may I ask, had not chloroform been in use? Would it have been an established operation in surgery? Could it have been so successful? The answers to these questions, I think, are plain; they must be in the negative. It is true the operation had been performed before its introduction; it had been successful in a few cases, but it had almost fallen out of practice; its revival was due, without doubt, to chloroform, and its present established position to the general use of that drug. No operation requires more gentleness and nicety; and how could these essential points of practice be applied with a patient writhing under the agonies of an abdominal section. To all abdominal surgery the same observations are applicable, although they may not tell, perhaps, with the same force.

"Let us refer, now, to another class of cases; to that large one known as belonging to plastic surgery. How many cases of vesico or recto-vaginal fistula were successfully treated by operation before chloroform was introduced? At Guy's Hospital I can find no such record. The physician-accoucheur used to cauterize the margins of the fistula, it is true, but, I fear, with poor success; for I have never heard of a case of any size being so cured. At the present day these cases are now to be cured by operation with as much certainty as any other class. They have, in truth, been moved from the incurable to the curable affections. And yet these instances of plastic surgery are only a portion of those which I might enumerate.

"In the treatment of deformities about the mouth, nose, and eye; in the division of cicatrices after burns; in the treatment of ruptured perinæum, with all its complications—what innumerable cases might be quoted now, against the few of former times!

"Again: in the operations on bones and joints, how many of the improvements in our practice are there that may not be put down to the use of chloroform?—operations for necrosis in particular. How rare these were, and how unsatisfactory they must have been before its introduction! I can recall a few which I saw in my student's days with no pleasant feelings. How common they are now, and how successful! Taking Guy's as a type of the metropolitan hospitals, an operation for necrosis can always be found for operating days—the operation is so frequent and so satisfactory. In the removal of bone from joints, in the excision of joints, is it not fair to believe that a great part of the success which now attends the practice is to be attributed to the use of an anæsthetic? How many hands and feet, which would formerly have been sacrificed, are now saved by the removal of diseased bone, it is difficult to estimate. Would Sir W. Fergusson have framed the phrase 'conservative surgery,' and could it have been adopted, before the introduction of chloroform?

"In the treatment of aneurisms, are not like improvements to be recorded? Has not chloroform rendered possible the cure of aneurism of the abdominal aorta by pressure? and in the same way improved the treatment of less severe examples? Has it not also rendered the practice of torsion of arteries for the arrest of hemorrhage a practical success, thus simplifying surgery? How many cases of strangulated hernia are now reduced, which in former times would have been submitted to strange treatment and to a delayed operation? How simple it has comparatively rendered the reduction of recent dislocations! Where are now the pul-

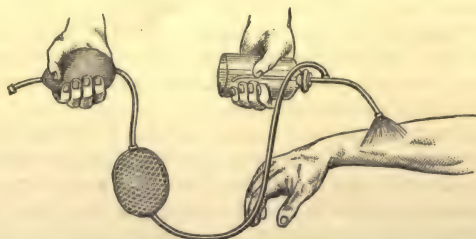
leys, the ropes, and the other frightful mechanical appliances, that were used of old for the reductions of dislocations of the hip, shoulder, and other joints? Are they not decaying in the lumber-rooms of our hospitals? and has not the use of chloroform made the reduction of dislocations by manipulation a reality? Within the last few weeks, I reduced, with ease, by manipulation, a dislocation of the elbow-joint backward, complicated with fracture of the radius, which would probably have been left unreduced before the introduction of the anæsthetic; and more recently the head of the humerus dislocated on to the dorsum of the scapula, complicated with fracture through the tuberosities.

"Let us contrast for one moment the operation of perineal section for stricture as it was and as it is now performed. Do we not all remember it as one of the most unsatisfactory and unsuccessful of surgical operations? Do not we now know it to be one of the most satisfactory and successful? Indeed, I might continue the contrast between the prechloroform and the present age; but I think I have said enough to show that to the introduction of chloroform many of our best improvements in surgical practice are to be attributed. For the surgeon it does away with all excuse, if any ever existed, for hurry in an operation. He can take his steps in it with deliberation, and make it a certainty. We never see now, happily, a theatre full of spectators watching the operation with in hand; and I trust there are few, if any, surgeons who at the present day sacrifice safety and certainty in their operations for expedition and display. The use of chloroform has rendered the practice of surgery safer, surer, and more scientific. It has removed difficulties from the practice of our art which before were insurmountable, and has rendered possible innumerable things that could not in former times have been entertained."

Local anæsthesia may be brought about by freezing a part, as suggested by Dr. J. Arnott, or by means of the rapid evaporation of pure anhydrous ether, as practiced by Dr. B. W. Richardson. Both are valuable means of diminishing pain where anæsthesia by inhalation is forbidden or inapplicable. Arnott's plan is to be carried out by mixing up finely pounded ice in a gauze net or thin translucent india-rubber bag with half its bulk of powdered salt, the net being placed over the part to be benumbed. If well applied it renders the skin at once pale and bloodless and, if continued, of a tallowy death-like aspect; when too long applied it may produce frost-bite or chilblain.

Dr. Richardson's ether spray is a far more elegant mode of applying local anæsthesia than ice, and it is also more effectual. It is worked by his

FIG. 478.



Dr. Richardson's apparatus.

well-known apparatus, consisting of a tube with india-rubber ball and second spring ball to make the current continuous, the air being pumped

in through this tube into a bottle containing anhydrous ether of a sp. gr. 0.723 and of a boiling-point of 96° Fahr. Through the stopped neck of this bottle a glass tube is passed, which at one end reaches nearly to the bottom of the bottle and at the other is fitted with a point, with one or more perforations, through which the ether is forced in a fine spray, this spray being directed upon the part to be benumbed (Fig. 478).

For opening abscesses, taking out small tumors, the removal of external piles, and other minor operations, this local anæsthesia is of great value; but in graver surgical acts it is a delusion, it only affects the surface, it is only skin-deep in its influence.

CHAPTER LXXXIX.

SHOCK AND COLLAPSE.

A MAN receives unexpectedly some startling news, exciting severe mental emotion, and dies suddenly, he is said to have died from shock; a second receives a blow upon the epigastrium with the same result; a third is struck dead by lightning, and death is assigned to the same cause. In all the heart's action is suddenly arrested through the nerve centres—in one case through the emotions, in the others through the body. Under these circumstances the heart is found full of blood, with all its cavities distended, this distension paralyzing the action of the organ.

A man receives a severe compound fracture, gunshot or other injury, a violent general shaking of the body; he is not killed, but collapsed. He has sustained a shock more or less intense, and, as a consequence, is cold and almost, if not quite, pulseless. His skin appears to be bloodless, and covered with a cold clammy sweat. He may breathe almost imperceptibly, feebly, or with sighs and gasps. His nostrils will, probably, be dilated; the eyes dull and vision imperfect; consciousness may be present to very variable degrees, for the patient may possibly be roused, but, as a rule, he requires rousing to prove its existence. At other times the intellect remains quite clear.

These are briefly the signs of collapse, or of shock the result of injury. They are to be found in variable degrees after most accidents, and are by no means usually fatal, unless the injury itself is fatal. Of course if the shock from the injury is very great the heart may cease to beat and the lungs to breathe, collapse passing, more or less slowly, into death; but more usually after a variable period, the heart's action gradually improves, the respiratory act becomes more regular, and perfect color returns to the bloodless lips and skin, warmth reappears on the surface of the body, and consciousness becomes more manifest, these symptoms indicating what is known as reaction, and when they pass into excess febrile symptoms may appear. It should be noted that vomiting is often the first indication of reaction in general collapse, as it is often in that of head injuries. Should the nature of the accident be such that hemorrhage complicates the case the collapse will be more lasting, the shock of the accident passing into the collapse of the hemorrhage, and under such circumstances a fatal result is very likely to appear, the amount of bleeding and its rapidity determining the result, for it should be known that hemorrhage by itself is enough to produce collapse, or syncope, and this added to the shock of the injury is more than

enough to destroy life. In abdominal injuries this connection of events is well seen, the hemorrhage from a lacerated liver or other organ, as a rule, appearing with the first manifestations of reaction from the shock of the accident, and thus proving fatal.

The longer reaction is delayed the more grave is the aspect of the case, and when it appears it need not necessarily go on to its establishment; for not rarely relapses appear, signs of reaction and others of collapse alternating in variable degree till one or the other is established in a recovery or the reverse.

In rare cases reaction, even from the shock of a slight accident, is followed by exceptional symptoms; thus, not long ago I had a man under care, who was admitted with a slight concussion of the brain, in whom reaction was attended with an acute attack of maniacal excitement, which left him after two days to pass on to a steady convalescence; a woman with a similar injury, attended with a scalp wound, had a like attack, which lasted two weeks and then subsided without any bad results. I have recorded also, in a former chapter, a case of general tetanic spasm, which showed itself in the reaction after a case of spinal injury. More commonly reaction is attended with what Travers has described as "prostration with excitement," a state bordering on, and often passing into that known as delirium tremens.

Under some conditions of the system shock and collapse are more readily produced than they are at others. When general feebleness, from age or otherwise, mental or physical, exists, this is well seen, subjects so situated being unable to withstand the effect of any shock. Patients with bad kidneys, again, are very prone to suffer from shock, and to succumb to any operation, however trivial. Surgeons see this at times in the sinking after small operations. Thus, I lost some years ago a woman of middle age after the removal of a fatty tumor, simply from asthenia; the operation was unattended by any loss of blood, but the woman sank; and a child, *æt.* 8, after some operation on a cicatrix of the neck, in the same way. In both, bad kidneys were found after death. The idiosyncrasy of the individual has also a powerful influence on "shock."

TREATMENT.—Shock or collapse uncomplicated with hemorrhage may be treated in one way; shock or collapse the consequence of or combined with hemorrhage in another.

In both cases the heart's action must be either excited or maintained; "the heart must beat, and the patient must breathe," or life will fail. Even in the worst cases, as long as any signs of life exist, the respiratory process may be aided by artificial respiration, and the warmth of the body kept up by external applications; and even if no evidence of the heart's action be detected, and no hemorrhage complicates the case, Savory, in an able article ("*Holmes's System*," Ed. 2, vol. i), advises, as the result of experiment and reason, that a vein should be opened—as the external jugular—in order that the over-distended heart may resume its action as soon as it is relieved from its paralysis by distension.

In the extreme collapse following hemorrhage transfusion is also "a fair and rational expedient."

In less severe examples the surgeon's object is to keep the patient alive, but he ought not to wish to do more; to force nature is always injurious, and sometimes may be fatal. The failing powers of a feeble subject may be excited to act only to give way again, when they may not respond to the former stimulant.

A too rapid reaction may so stimulate the heart as to set up a fatal

hemorrhage, when by the collapse the wounded artery might have become sealed by nature's own blood-clot.

In all cases of shock and collapse, therefore, complicated with local injury, great judgment is called for. To do enough to maintain life is essential, to do more is injurious.

The horizontal position under all circumstances is to be observed, and the external warmth of warm blankets, &c., applied; hot flannels to the pit of the stomach are very good. Stimulants in carefully adjusted quantities may be given, brandy being the best. This is to be given in small quantities, and should the heart's action fail to respond to its administration after two ounces or so have been swallowed, more is of little use, the stomach usually rejecting it. When the stomach rejects brandy, or the patient cannot swallow, an enema of brandy in warm starch, milk, or gruel, sometimes acts very rapidly. As soon as the heart's action is established, liquid food, such as warm milk, may be given, but only in small quantities, and the case watched, such food and stimulants being given with discretion as the symptoms indicate, the greater the loss of blood the greater being the necessity for food.

Excess of reaction is to be checked by soothing remedies, opium in any of its forms, henbane, and chloral, are very valuable drugs, a few hours' calm sleep generally acting like a charm, but when brain complication appears this treatment is to be adopted with care. Anything like coma contra-indicates it.

In compound fractures and other local injuries demanding operation it is an important question to decide as to the wisdom of operating on a patient in a state of shock. Will the operation act as a stimulant, and tend to rouse him? or will it act as a second shock, and tend the other way? When the shock is severe, and the patient almost pulseless, it is doubtless the wisest plan to postpone all operative interference till the heart's action is re-established. To amputate a limb under extreme collapse is to destroy all chance of life, or to do an unnecessary operation. To amputate when reaction has set in after the lapse of a few hours, when external warmth, stimulants and tonics have had their influence, is far more likely to prove successful.

In less severe examples of collapse, however, the same practice does not seem to be necessary, more particularly when hemorrhage has been the partial cause, and is still continuing, for when collapse is present the loss of very little extra blood by oozing forbids any hope being entertained of a good reaction being established, and thus no good can be acquired by delay, but only harm. The administration of chloroform has, moreover, a stimulating influence upon the heart and nervous system, which is often very valuable. I have often performed primary amputation upon subjects in a state of partial collapse after injury under these circumstances, and have never regretted it. With a patient in a state of collapse no amputation should, however, be performed when by delay no harm can accrue. When hemorrhage, however trivial, is going on, or is likely to recur at any moment, the surgeon should interfere and remove the part when its removal is essential.

When the collapse is associated with semi-consciousness chloroform is not needed, the operation itself acting as a sufficient stimulant; but when the mind is clear to what is going on, its use should not be withheld, for although it is true its secondary effects are sometimes depressing, and may be injurious, in a general way it has a beneficial influence, and tends to prevent a second shock, both mentally and physically.

When extreme collapse exists.—"How far," writes Savory, "the patient

should be allowed to rally, and when he has reached that state which will enable him to bear the operation, are, of course, questions which cannot be answered in a general manner, but which must be decided by the surgeon in each case."

Where the surgeon is in doubt about acting he had better decide in favor of delay. When no doubt exists as to the wisdom of removing an injured part, and by delay harm must or may probably ensue, he had better act at once, even when the patient has not quite rallied from the shock of the injury. When, so far as the local injury is concerned, the delay of a few days or hours is unimportant, all operative interference should be postponed.

In severe compound fractures, gunshot or otherwise, hemorrhage is almost sure to occur as soon as reaction appears, and the shock of the removal of a limb is not so much to be dreaded as the loss of blood. "Wounds of the large arteries of the legs and arms from balls and shells always bleed more or less at the time of reception, and more freely as the shock to the nervous system passes off and reaction comes on. Even when this nervous shock is not sufficient to produce immediate death, the chances for ultimate recovery must frequently turn on the mere question of loss of blood." (Hammond, U. S.)

In military practice primary amputation upon the field is now generally preferred to secondary, and in civil practice a like rule should be enforced under analogous circumstances.

To perform any capital operation upon a patient in a condition of extreme collapse or shock is bad practice. To do so, however, when a minor degree exists, and the pulse is to be felt, when by delay other dangers are to be expected, such as continued or renewed hemorrhage, is sound and good surgery. To an unconscious or only slightly conscious patient, chloroform is not needed. To a conscious one it has often a beneficial action, and tends towards the encouragement of reaction.

CHAPTER XC.

AMPUTATION.

WHEN a limb is saved by the excision of a joint, or life prolonged by the torsion of, or the application of a ligature to a wounded artery, surgical science claims a triumph; and surely an equal triumph ought to be placed to her credit, when life is rendered more valuable by the removal of a part that interferes with its duties; when death is warded off by the amputation of a limb that is irreparably injured, or of a disease that is otherwise incurable? To say that amputation is an opprobrium of our art is to take a narrow view of its objects; to say the same of the science upon which it is based is as false as it is unfounded. *To save life* is the first object of the surgeon, and to do so by the necessary sacrifice of a limb is the truest "*conservatism*." To sacrifice a limb unnecessarily is an error which the surgical mind would never willingly commit, but to sacrifice life in the feeble effort to save a limb is an event of far greater magnitude; it is one that timid surgeons are too prone to fall into when inoculated with the narrow views of a spurious conservatism. For its avoidance a high order of knowledge is demanded, a careful balancing of probabilities, and much decision. To

leave a limb alone with the view of saving it is a passive act of the professional mind that requires no effort; to make up the mind to act demands much effort backed up with knowledge and a full sense of responsibility.

To perform the operation of amputation requires nicety and well-applied mechanical skill; to determine upon its necessity or non-necessity needs full knowledge and decision.

In the present chapter it is not my intention to discuss the conditions on which amputation may be called for. These have been as fully considered as the scope of this work will allow in the various chapters devoted to the different subjects in which such treatment may be called for, and to those the reader must be referred. In this place I propose simply to consider amputation as an operation, to point out the best modes of its performance under different conditions, and to describe the various forms of operation as applicable to different parts.

To go over the history of amputation would be an interesting but a too extended process. In "Cooper's Surgical Dictionary" and "Holmes's System" two able articles will be found upon the subject, which contain all that can be looked for. For the present purpose it will be enough to state that the first amputations were performed by the *circular method*, the soft parts being divided down to the bone by a circular sweep of the knife (*vide Celsus*), the hemorrhage being arrested by the red-hot iron, and the bone divided by a saw.

About 1718 J. L. Petit, the French surgeon who improved the tourniquet, which is now known by his name, and Cheselden, our own great surgeon, suggested that the skin and fat of the limb to be removed should be first cut through and retracted, and the muscles and bones divided as high as they were exposed. Still later, Louis, of Paris, adopted the practice of dividing the skin and superficial layer of muscles by the first cut, the deeper muscles down to the bone by the second, at the line of the retracted superficial ones, and then the bone; he also used a retractor.

In 1779 Alanson, of Liverpool, made a still further advance. He divided the integument as usual, and allowed it to retract, but divided the muscles more after the modern flap operation, obliquely upwards, cutting from without down to the bone, the bone being then divided; the soft parts on being brought down formed a conical cavity, the bone being at the apex: Alanson's object was in this to prevent the sugar-loaf stump. Still later, Benjamin Bell, of Edinburgh, and Hey, of Leeds, secured the same end by first dividing the integument with a circular cut, and dissecting it up; then the muscles at a higher level; and, lastly, the bone, this being divided at a point considerably above the line of the retracted muscles. Hey, moreover, in the thigh amputations suggested the expediency of dividing the posterior muscles longer than the anterior, to compensate for their greater retraction.

The *flap operation* is a more modern one than the circular, and to Mr. James Young, of Plymouth, is due the credit of having first published, in 1678, the method which he tells us he had "from a very ingenious brother of ours," Mr. C. Lowdham, of Exeter. He made one flap only of skin, dividing the muscles by the circular plan, and stitching the parts together. Eighteen years later Verduin, of Amsterdam, made the first muscular and skin flap by perforating the limb and cutting outwards (transfixion).

To Liston, however, must be attributed the credit of having fully established the flap operation in practice, and in the pre-anæsthetic period, when time was a point of consideration, the great expedition with which such an operation could be performed by transfixion compared with the tediousness of the circular, tended much towards this end. It was also thought that

a large mass of muscle was a good covering to the bone, and formed a better stump than that in the circular; but experience soon proved that this opinion was not supported by facts, that the supposed advantages were not real, that they did not compensate for the larger extent of wound that the flap operation yields and for the evil of having often to tuck in the projecting ends of the divided muscles before the integuments could be adjusted. Liston himself saw this before he died, and with Syme was led to modify his operation, making in muscular subjects two lateral skin crescentic flaps with their convexity downwards, dividing the muscles as in the circular; and this operation is by far the best for all amputations of the leg and forearm.

In more modern times Lowdham and Young's practice has found expression again in Carden's operation, while Teale's amputation must be regarded as a modification of the flap. Both these gentlemen, however, advocated the long anterior flap in preference to all others, Teale making two rectangular flaps of unequal length of skin and muscle (Fig. 483), and Carden a rounded anterior flap of skin alone (Fig. 484); and under certain conditions nothing can be better than the results obtained, the line of cicatrix being posterior to the extremity of the stump and out of harm's way, and thus allowing the patient to rest part, if not all, his weight upon the stump.

The chief objections to the operation consist in the tendency there is for a long skin flap to slough, and the necessity of dividing the bone at a higher level than would be required in the circular operation, when a long flap cannot be otherwise made. In muscular subjects this last objection is a serious one, and in many thigh amputations a fatal one to the operation, for it is a truth that cannot be too forcibly recognized that, in the thigh, with every inch of bone removed is the danger to life increased. The surgeon who invariably practices Teale's amputation will often sacrifice a large portion of a limb that might otherwise be saved. He will have to amputate it at a higher point than is always necessary, and he will thus often add to the danger of the case and do what is consequently a needless and unjustifiable operation. The surgeon who removes such portions of the body as require removal, and no more, and who can do this by such a flap as Teale's or Carden's—that allows the cicatrix to be placed behind the stump and out of harm's way—will perform a good and scientific operation.

Under all circumstances any form of amputation must be looked upon with favor that takes away *only* what needs removal; that provides sufficient integument to cover the end of the stump; insures that the cicatrix is out of harm's way, and that no nerves are likely to be involved in the cicatrix or fixed to the end of the amputated bone. Any form of amputation must be regarded with disfavor that demands the removal of more of the body than is essential to carry out the surgeon's primary aim, and that increases the risk of the operation, however good the stump may be that is secured. To provide sufficient integument to cover the stump is a wise and necessary measure, and to fail in this when circumstances do not compel must be regarded as bad surgery; but in certain cases of injury, disease, or gangrene of the extremities, where no sound skin is left from which to make a flap, and yet it is advisable to take away the diseased or injured parts, amputation should be performed without regard to a covering for the stump, for it is, doubtless, better surgery to remove the diseased part that is hastening on the end and allow the stump to granulate, than to let the disease have its way and sacrifice life. At the hip- and shoulder-joints, where this contingency is most likely to occur, the adoption of this practice is not rarely called for, and at other parts it seems equally applicable; for knowing how well stumps often turn out when the whole skin and soft parts,

that at the time of the operation covered in the bone, subsequently sloughed, I am tempted to think that in certain injuries to the arm and leg the surgeon would be justified in amputating at the elbow- or knee-joints with a poor flap, leaving the rest to nature, rather than risk life by amputating higher up in the shafts of the humerus or femur. I have on several occasions, to prevent the necessity of amputating above a joint in order to make a good stump with a skin covering, amputated below, utilizing only some injured skin or bruised tissues, and have never been disappointed in the result, the stump subsequently granulating well, even when all the flaps themselves sloughed. In injuries to the leg this point is of great importance, for the mortality of amputation of the thigh for injuries is very great. As an admirable illustration of the value of this practice a case may be referred to (Circ. No. 3, Washington Army Depart., p. 216), in which recovery ensued after all four limbs of a man, æt. 26, were amputated on account of frost-bite. One month after the injury, when the line of demarcation had exposed the bones, Dr. Muller, in order to save loss of blood, which would have been serious in his weak condition, "dissected as much healthy flesh from the radius and ulna as the line of demarcation would admit without cutting any bloodvessels, and then sawed through the bone. This operation was performed on both arms with hardly the loss of any blood. The third day both legs were amputated in the same manner. In this case the four stumps could not be covered with sufficient skin, and much had to be left to self-reparation, which took place to an extraordinary extent, the four stumps healing over with healthy granulations, some little exfoliation of bone taking place in two."

Again, is it always necessary to amputate through healthy tissues? And to gain this end is it expedient to amputate higher up than would otherwise be necessary? I unhesitatingly answer that such practice is not called for. To amputate through diseased tissues, tissues infiltrated with cancer or other new growths, would, of course, be futile and bad surgery; but to cut through tissues that are merely infiltrated with inflammatory products, tissues that are pathologically reparable and clinically of use, is a wise and conservative process. In disease of the knee-joint, when suppuration has spread up the thigh into the soft parts, amputation may often be performed through the condyles or just above them, and a good stump secured; when by following another practice a much higher amputation would be called for, and, consequently, increased risk to life incurred. Tissues infiltrated with inflammatory lymph, indeed, often unite rapidly and well, and I have seen "brawny flaps" unite by primary union, as well, at least, as others not so infiltrated.

But of this I am convinced, that however desirable it may be to obtain good, long, and healthy flaps in all amputations, the advantages of such are not so great as to justify the surgeon in sacrificing more of the body than is essential, and more particularly of amputating above a joint, and thus adding to the risks of the case. It is true that one form of amputation often secures a better stump than another, under most favorable circumstances; but it is equally true that good stumps are often obtained under the most unfavorable conditions, and that bad stumps follow the amputation of a limb in which flaps and every other point promised to bring about a favorable result. To assert that the form of amputation, or rather that the shape of the flaps, &c., has anything to do with the relative mortality of different amputations, is not yet proved; indeed, what evidence exists points to a different conclusion, for the success of an amputation, as of any other operation, turns more upon the conditions of the viscera, age, and general conditions of the subject; accepting it as a fact that

the older the patient the greater the danger, and the more of the body that is removed the greater the risk. My own conviction is that, however desirable it may be to obtain a model stump, the end is not sufficiently certain or important to justify the surgeon in adding one tittle to the risk of the operation, or in sacrificing more of the limb than the necessities of the case demand. I look upon it as bad and unjustifiable surgery to perform a Syme's or a Pirogoff's amputation when a Chopart's will suffice; to amputate a leg when the removal of a foot at the joint will answer the purpose; to take off a leg or a thigh one inch higher than is absolutely called for, in order to execute what may be looked upon as a good operation, or to gratify a fancy; to amputate through the condyles of the femur when an amputation at the knee-joint can be performed, or through the shaft of the femur when the like end may be secured by cutting through the condyles. The surgeon must ever look upon the operation of amputation as an unfortunate necessity; he must bear in mind that it is to be undertaken only to save or prolong life, or to add to life's usefulness. With these ends in view, he must not add one jot to its dangers or take away one inch of the body more than is essential; the beauty of a stump, although something, is nothing if it is likely to be obtained by increased danger, and the brilliancy of an operation is a snare that should never be allowed to draw the surgeon away from the main object which alone gives the operation of amputation a high and scientific position in surgical practice,—the preservation of life.

The mortality of amputation is more determined by age than any other point, and to Mr. Holmes is due the credit of having statistically proved this fact ("St. George's Hosp. Rep.," 1866). In my own paper upon the causes of death in amputation ("Med.-Chir. Trans.," vol. xlii, 1859) this point was overlooked; but, following Mr. Holmes's example, I re-analyzed the cases upon which it was based, and have been somewhat startled at the very definite conclusions my analysis brings out. Thus—

Out of 103 cases under 20 years of age, 10 died, or 1 case in 10.

Out of 111 cases between 21 and 40 years of age, 21 died, or 1 in 5.

Out of 74 cases over 40 years of age, 22 died, or 1 in 3½.

The mortality nearly doubled in each period.

Mr. Callender's statistics ("Med.-Chir. Trans.," vol. xlvii, 1864) and Mr. Holmes's reveal the same tale:

	Cases under 20 years of age.	Between 20 and 40 years of age.	Over 40 years of age.
Callender's, .	61 cases, 3 died.	92 cases, 20 died.	74 cases, 30 died.
Holmes's, . .	83 " 10 "	127 " 35 "	90 " 38 "
	144 cases, 13 died, or 1 in 11.	219 cases, 55 died, or 1 in 4.	164 cases, 68 died, or 1 in 2½

If the causes of amputation are looked at in the same light, the results become still more marked, for dividing them into amputations for disease, accident, and expediency, the latter term including amputations for tumors, deformity, &c., the following facts came out:

	Diseases. Cases. Died.	Expediency. Cases. Died.	Accidents. Cases. Died.
Under 20 years of age, .	68 4, or 1 in 17.	9 3, or 1 in 3.	26 3, or 1 in 9.
Between 20 and 40, . .	66 12, " 1 " 5½.	15 4, " 1 " 4.	80 5, " 1 " 6.
Over 40,	33 5, " 1 " 6½.	9 3, " 1 " 3.	32 14, " 1 " 2½.

Amputations for *acute* suppurative disease are most fatal, and should

only be undertaken when a strong necessity exists. I pointed this out in 1859, but it is not a fact sufficiently recognized.

Amputation in young life for chronic disease is most successful, being three times more so than it is at a later period, one only in every seventeen cases dying; amputation for accident increases in fatality with age; and amputations of expediency are as dangerous at all periods of life as traumatic amputations are in the aged.

Mr. Callender has also well shown ("St. Barth. Hosp. Rep.," 1869) that the mortality of amputations is much alike, whether performed in country hospitals, in country private practice, or in country cases in London. In amputations on London subjects, as in the subjects of all large towns, the mortality is something higher.

Dr. Steele has, however, gone somewhat further and has proved by figures that amputations performed in London for injury on country patients are, as a rule, more favorable than when performed in town cases, the difference between the two classes being far less marked in amputation for disease ("Guy's Hosp. Rep.," 1869-70) than for injury.

The causes of death after amputation are as follows, taking these conclusions from my paper on the subject already referred to ("Med.-Chir. Trans.," 1859), to which the reader must be referred for more detail. *Shock* and *exhaustion* claim one-third of the fatal cases, and one-twelfth of all amputations. *Pyæmia* was the cause of death in 42 per cent. of the fatal cases, and in one-tenth of all amputations. *Secondary hemorrhage* in 7 per cent. of the fatal cases, or $1\frac{1}{2}$ per cent. of the whole number. Some *complication*, cerebral, thoracic, or abdominal, causes death in about 4 per cent. of all cases. *Pyæmia* is nearly twice as fatal after amputations of expediency as after those for disease or primary amputations; it is less fatal after secondary amputations than all others; in amputation of the leg it is twice as destructive as in that of the thigh, the larger section of bone being the more dangerous. In primary amputation of the leg it is more fatal than for disease.

How far the deaths from secondary hemorrhage will be diminished when the practice of torsion of arteries is more general remains to be proved, although from the experience we have had at Guy's Hospital the promise of a better result is very great. Up to the end of 1871, out of 102 amputations of the thigh, leg, arm, and forearm, in only one case did secondary hemorrhage occur, and that was in a case of my own in which the whole arm stump sloughed with the artery. In two others bleeding took place from the stumps within a few hours of the operation, but not from the main arteries, but from muscular vessels that had probably been overlooked. In 55 of these cases the amputation was of the thigh, in 21 of the leg, in 6 of the foot, in 4 of the shoulder, 12 of the arm, and 4 of the forearm. The oldest thigh patient was sixty-two years of age, the oldest of the leg amputations seventy-one, of the arm sixty-five; 12 of the whole number were over fifty years of age, 15 between forty and fifty. Thus, vessels of the young and old were twisted with equally good results. I may add that our house-surgeons never expect to be called to cases of secondary hemorrhage now torsion is the general practice of the hospital.

The operation of amputation may be called for on account of some incurable disease or some incurable injury. When performed for the first cause the operation has been described as a *pathological* amputation, when for the second as *traumatic*. Both classes are also subdivided, the pathological into amputations for suppurative disease of bones and joints—pure *pathological* amputation; and into those for talipes, tumors, deformity, &c., amputations of *expediency*.

Traumatic amputations performed during the first twenty-four hours after the accident, before any inflammatory complications have appeared, are called *primary* amputations; the term *secondary* being applied to the same class of cases after suppuration has appeared; the term *intermediate* being used for amputations performed twenty-four hours after the accident, but before suppuration has set in. This distinction is not, however, a satisfactory one.

Some statisticians have classed the secondary amputations with the pathological, but this practice is clearly wrong.

The various operations may be divided into three great classes—1st, the *circular*; 2d, the *flap* operation, whether by transfixion or cutting from without inwards—Teale's amputation, consisting of one long anterior skin and muscular flap, and short posterior, is looked upon as a modification of the ordinary flap operation; 3d, the *mixed form* of amputation—skin, flap, and circular muscles—Carden's operation is included in this series.

Into one or other of these classes nearly every form of amputation may be brought, although practically there are innumerable modifications of each, more particularly of the flap.

The old circular, as already described (p. 935), is now fairly abandoned; it has no advantages over the more modern mixed form of amputation, and will not take the place of the flap where the latter is applicable. In small limbs, where there is but little muscular tissue and a single bone to divide, it may be performed, but it cannot be recommended. It is more practiced abroad than in this country.

The flap operation doubtless owes its popularity as much to Liston, Lisfranc, and Velpeau, who were its strong supporters, as to the facility with which it is performed, and the satisfactory appearance of the flaps at the time of the operation. Before anæsthetics were introduced expedition was of importance, and it was the surgeon's aim to remove a limb as rapidly as possible. "The surgeon operating by the watch took off a limb by the flap operation in as many seconds as there were minutes occupied in the old circular method." (Sir W. Fergusson.) Since 1846, however, when anæsthesia came into vogue, this necessity has ceased to exist, and surgeons have been led away more from the flap operation to what may now be described as the mixed.

In certain parts, however, the flap amputation still holds its ground, and in a general sense, it may be said that in operations where *the shafts of single bones* or some joints are involved it is the best method. In some localities it is the only one open to the surgeon, as at the shoulder and hip-joints.

The objections to the flap operation are the large surface that is exposed, the danger of puncturing or splitting the main artery of the part, the inconvenience of bleeding, the leaving of the main artery and nerves in one of the flaps, and the disadvantage of a thick muscular flap.

The flap amputation has, however, one great advantage, and that is its capability of innumerable modifications. Thus, both flaps may be made by transfixing—the old plan; both may be made by cutting from without inwards; one flap—the anterior—may be made by the latter method, and the second, or posterior, by transfixion; or lateral flaps, single or double, may be made, or oval flaps.

The *advantages* of transfixing the flap are seen in the rapidity and cleanliness with which the section of the muscles and deeper parts is made; its *disadvantages* in the irregularity with which the skin is too often divided, the elastic integuments stretching before the knife, and the flap consequently presenting an irregular outline. By the plan of cutting the flap from without inwards this disadvantage is, however, neutralized, and an

extra one is gained, for the surgeon can often cut a longer skin flap than a muscular one, and in large limbs this is a point of importance.

In some amputations, as of single bones, the operation may be well performed by cutting the anterior flap from without inwards, and the posterior by transfixing. In the arm and thigh, when I select the flap amputation, this method is one I rather like. In cutting the posterior flap by transfixion, particularly in the thigh, the surgeon should always support it with his left hand, and when a sufficient flap has been made, cut sharply backwards (Fig. 480).

Sir W. Fergusson says, with respect to the flap operation, "If, in transfixing, the flaps be made purposely short, and then, retraction being made, the knife be carried round the exposed tissues which cover the bone, a cone will be formed resembling that in the ordinary circular operation, and thus by a combination, a compromise of the two methods (the circular and the flap), a covering to the end of the bone, in other words a stump, will be left superior, in my estimation, to any other." ("Lect. on Prog. of Surg.," 1867.) "I feel assured, however," he adds, "that cutting from without inwards is in many instances followed by the best results."

Besides these recognized forms of amputation many others are performed, the surgeon having too often, like the tailor, "to cut his coat according to his cloth," particularly in cases of injury. He has to utilize what skin there is left uninjured, to prevent the necessity of amputating higher up than can be avoided; it may be that one external or internal flap can be made, one anterior or posterior—in fact, any form or combination of flaps the surgeon may be called upon to make to carry out the object he has in hand—the removal of the part that must be removed, and no more, with the least sacrifice of parts. Indeed, as already alluded to, under rare circumstances, to carry out these views, an amputation may be performed without flaps, or with poor ones, it being a safer and, I believe, a sounder practice to take off a part that *must be* removed to save life immediately above the seat of injury, even with bad, poor, or no flaps, than, for the sake of making flaps that may slough, amputate higher up, possibly with the sacrifice of a joint, and thus incur an unnecessary danger to the life we are operating to save. Petit's fundamental rule is far from true, that "as little of the flesh should be cut away as possible, but the more the bone is removed the better." ("Traité des Malad. Chir.," tom. iii, p. 250.)

As a variety of the antero-posterior flaps the surgeon may at times by transfixion make the posterior one first, and then, taking between his fingers and thumb all the soft parts not included in the posterior flap, complete the operation, either by passing the end of the knife beneath these tissues and cutting outwards, or by cutting from without inwards, as in the former case. This plan is most expeditious; it was one commonly employed by the late Mr. Morgan, of Guy's.

In some cases two lateral flaps may be made, either by transfixion or by cutting from without inwards.

The Flap Operation.—The surgeon having decided upon the operation, and the consent of the patient or of his friends having been obtained, it will be well, when time permits, to see that any fecal accumulation is removed by either a mild aperient or enema, given thirty-six hours beforehand, and as good a meal as the patient can take given four or five hours before the time fixed for the operation; meat, where possible, with some stimulant, and a mixture of milk, egg, and brandy, when solids are not acceptable; for assuming that chloroform or some anæsthetic is to be administered, it is essential to have the process of digestion fairly completed beforehand, to guard against sickness, which is more prone to take place

with a full stomach than with an empty one. The part should be well washed and shaved beforehand, when much hair is present, and dressers should see that this is done before the patient is brought into the operating theatre.

All instruments and dressing appliances should be arranged out of the patient's sight before the time of the operation, and a sufficient number of assistants provided and their special duties allotted.

Thus, on one tray there should be a tourniquet, to prevent hemorrhage, amputating knives of sufficient length and size, a bistoury or catlin to divide the soft parts; for the treatment of the bone, saw or bone forceps; and good torsion forceps to twist the vessels, or ligatures to tie them. The torsion forceps I employ (Fig. 49) are as good for taking up an artery to tie as for twisting; a tenaculum should likewise be at hand to take up vessels that have retracted, and a pair of scissors.

On a second tray every appliance for the dressing of a stump should be arranged, such as suture needles armed with waxed silk, wire, or carbolized catgut, strapping cut into sufficient lengths and breadths, lint for pads or dressings, and splints, when applicable; a can for hot water to heat the strapping not being forgotten. Hot and cold water in abundance, clean sponges supplied by the surgeon, well squeezed dry, and soft towels being so arranged as to be always at the surgeon's command during the operation.

When the operation is to be performed by daylight the table is to be placed near a window, where the best light can be obtained, and when by candlelight sufficient provision must be made. A good operating lamp is of great use.

With respect to assistants, one good one to give chloroform is a necessity, and, when possible, he should be an expert, to whom the surgeon can confide his patient with confidence, for it is trying and somewhat risky for the operating surgeon to have an eye to the chloroformist when otherwise engaged. A second is wanted to hold the limb above and command the artery of the limb; a third to hold the limb below till it is removed, and then to sponge and help to twist or tie the vessels; and a fourth is of essential service in amputation of the thigh and leg to do anything the surgeon may require—hand the instruments, sponge, &c., &c. They should be placed as shown in Fig. 479.

The nurse should be near to take away and clean all sponges as they are used, and replace them with others, well squeezed dry.

The operating table should be a narrow and a steady one, a kitchen table with flaps being about the best, and it is always available. In hospitals a special table ought always to exist.

In amputations of the upper extremity the patient should be brought well to the side of the table, and in amputations of the lower extremity well downwards, the opposite limb being secured by a turn of a bandage or strap to the leg of the table.

In amputating, the surgeon should always stand on the *right hand side* of the amputated part, in order to keep full control over the flaps, and, possibly, of the main arteries, during the operation, and of the stump after it. He should see that the tourniquet is so fixed as to control the vessel when screwed up, although this should on no account be done till the operation is about to be commenced. Indeed, to empty the limb to be amputated of its venous blood, it is a good practice to raise its end for one minute before finally fixing the tourniquet. The artery may be controlled by digital pressure, either applied by the surgeon or his assistant, but, as a rule, the use of the tourniquet is a safer practice.

In the flap operation now being considered—and for the sake of illustration, I will suppose it to be a thigh—the surgeon should mark out with his eye the point at which he proposes to divide the bone, and, with his thumb on one side the limb and fingers on the other, grasp the limb at a spot corresponding to the base of the anterior flap he is about to make, cutting

FIG. 479.



Surgeon and his assistants arranged for an amputation.

from without inwards, taking care that the base of this flap is at least one inch lower down than the point at which the bone is to be divided. In making this anterior flap the integument had better be divided first; it should be as long as the soft parts below will allow, and long enough to cover half the stump, or rather more than half the diameter of the limb, longer it may be when possible, for the long anterior flap is now generally admitted to form the best stump. The skin flap should be a broad one, with the angles of the ends cut off, but not pointed; the muscles are then to be divided down to the bone with a clean cut of the knife made from heel to point. The skin and muscular flap should then be reflected. The anterior flap having been thus made, the point of the knife should be passed beneath the bone through the wound, and the limb transfixed, all the tissues that remained undivided being included. The knife should then be made to run downwards parallel to the bone, to make a flap of the required length, and turned backwards, the cut out being made sharply (Fig. 480).

During this stage of the operation it is well for the surgeon to support with his left hand the under surface of the posterior flap. When the anterior flap has been made only sufficiently long to cover half the face of the stump, the posterior must be cut of an equal length to allow these two to meet. When the anterior flap has been a long one, two-thirds of the required length to cover the stump, the posterior flap need only be half the length of the anterior.

The flaps having been made, they are to be carefully held away from the bone, and the bone bared upwards by two semicircular cuts with the knife, for about one inch above their base to the point at which the surgeon had intended to divide it; the periosteal covering of the bone and remaining soft parts are next to be divided, and the saw is applied, the bow saw (Fig.

479) being probably better than the ordinary one. It is to be used from heel to end with a firm, decided, yet free movement; too much pressure upon the saw is likely to cause splintering of the bone. During these steps

FIG. 480.



Amputation of the thigh by flap operation.

of the operation the assistant who holds the limb is to be careful not to elevate or depress it, for by the former act he will cause the surgeon's saw to become locked, and by the latter he will cause splintering of the lower border of the bone. The best plan for the assistant to adopt is to apply extension to the limb, as if to draw the patient downwards, but not with sufficient force to do so, holding the amputated bone itself when possible.

When any splintering of the bone has taken place the rough margin is to be carefully smoothed down with the cutting forceps, care being observed not to tear away the periosteum.

Dr. McGill, of the United States Army, has suggested the propriety of making two periosteal flaps to cover in the end of the divided bone in amputation, and gives three cases in which this was done with excellent effect (Cir. No. 3). I have adopted the plan on three occasions with excellent results.

The bone being sawn through, the stump is to be raised and the main artery at once seized, but not with its sheath; the coats are to be firmly held with the forceps (Fig. 49), drawn out of the sheath, and sharply twisted sufficiently often for the surgeon to feel that resistance has gone. The end should not be twisted off. The smaller arteries are to be treated in the same way, it being possibly the best practice to twist off the ends of the small muscular and cutaneous branches.

When ligatures are preferred they may be used, the carbolized catgut being probably the best.

As soon as the chief vessels have been secured, the tourniquet should be taken away, and the stump slightly elevated to assist the venous circulation, the assistant being ready with his finger to compress the main trunk of the artery of the limb should any vessel remain unsecured. Any nerve trunks that have been cut long in the flaps should be removed to a level with the bone. A stream of water may then be made to pass over the end of the stump to cleanse it of all blood, &c., and the surface dried with a soft towel, the surgeon satisfying himself completely that the vessels are all satisfactorily secured. The edges of the flaps may then be adjusted, and kept in apposition by sutures, which are not to be put in too closely; the

most dependent corner of the wound should be left open for drainage. The sutures are to be inserted about half an inch from the margin of the wound, and made to perforate the skin and fat obliquely to the free border of the flap. They may be of carbolized gut.

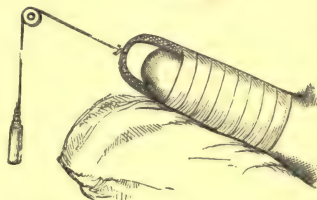
A posterior splint should then be fixed on the stump (Fig. 481), with pads of lint to maintain steady pressure upon the base of the flaps, but not upon the wound, and a piece of dried lint applied to the surface, a

FIG. 481.



Thigh stump, with splint.

FIG. 482.



Thigh stump, with splint for extension.

sufficient opening being left in the wound to allow of the escape of any fluid; cotton-wool enveloping the whole, and bound on, forms a good elastic covering. To seal a wound completely and not to leave a drainage opening must always be looked upon as bad practice.

The stump should not be dressed for three or four days unless it becomes uncomfortable and the discharge from it offensive, for the less the parts are disturbed during the early days the better, repair going on much more satisfactorily when the whole thing is left alone than when the dressings are too frequently performed.

When anything like retraction of the flaps exist, extension may be applied by means of a splint of perforated zinc, applied as seen in Fig. 481.

Before chloroform was introduced it was the late Mr. Aston Key's practice, and Mr. Syme's also, to leave the stump open for a few hours before its flaps were brought together; this was a good measure, for in that time every bleeding vessel showed itself, and the surface of the wound became glazed, and, therefore, good for repair; but since chloroform has been in use this practice has fallen into disuetude, for the pain of the second dressing is always severe, and to give chloroform for the purpose would hardly be good practice.

The stitches may be taken away on the third or fourth day and the parts supported by strapping should gaping appear or union not be solid, water-dressing to the wound being then all that is required.

Humphrey, of Cambridge, many years ago, was so impressed with the evil attending the retention of serum or other fluids after amputation, that he was led to dispense with dressings altogether; he left the wound exposed, and allowed a scab to form over its surface. This practice has been followed by some good surgeons since; and although, to my mind, it is not so satisfactory as pressure applied to the base of the stump, a free opening at its surface, and gentle support given to the whole by cotton-wool, it is far superior to the plan of covering the whole thing in by strapping and allowing no outlet for the escape of decomposing serum or other pent-up fluid, for no surgeon denies the evil influence of such fluids, or their power in giving rise to septicæmia.

In recent times, however, theories have sprung up which have originated new practices, and the most important is the one upon which the antiseptic

treatment of wounds is based. Lister is its chief advocate, and under the influence of his great authority it has established a position which deserves attention. The theory upon which the practice is based is one thing, the practice itself is another. At present the germ theory is certainly not established, although the practice has taken a hold of the professional mind, and has so much success to boast of that its value, under certain conditions, is not to be disputed. How much of this success is due to the great care which is required on the part of the surgeon who dresses the wound, and the close personal attention which any case so treated necessitates, is an open question; or how much depends upon the means employed for placing a wound as much as possible under the condition of a subcutaneous injury, is still open to discussion. I am disposed to think that this latter point is the more important, and that, where the conditions can be fulfilled, the practice is to be recommended. Many methods will secure the end in view, in the majority of cases, although Lister's may be the best in exceptional instances. The theory upon which this practice is based I give in Lister's own words; it is founded upon the labors of Pasteur, who believed he had proved "that putrefaction is not occasioned by the chemical action of oxygen, or any other gas, but is a species of fermentation analogous to that of sugar under the influence of the growing yeast plant, being brought about by the development of microscopical organisms, the germs of which, from their extreme minuteness, float in abundance in the air as constituents of its dust. This being once clearly understood, it is plain that putrefaction in wounds may be avoided without excluding the air, by dressing them with some agent capable of destroying the vitality of the atmospheric organisms, provided that it does not act with too great violence upon the human tissues. . . . Carbolic acid," adds Lister, "happened to be the first agent that I employed on this principle, and it still appears to be the most convenient for the purpose; it also has the advantage of being a local anæsthetic."

"In dealing with an accidental wound it is necessary first to kill any septic organisms introduced into it from the air or from contact with foreign bodies, and this is done by washing the cut surface thoroughly with a saturated watery solution (one of the acid to twenty of water), but even this is felt to be a somewhat uncertain process, because some mischievous particle, lurking in some interstice among the tissues, may possibly elude the action of the lotion, and subsequently propagate its kind and spread putrefactive fermentation throughout the wound. For it is important to bear in mind that the acid applied to the interior has no persistent antiseptic effect, but is speedily dissipated, being partly washed away by the discharge and partly absorbed into the circulation. When, however, the wound is made by the surgeon himself on a previously unbroken integument (as in amputation) he has it in his power to prevent putrefactive organisms from ever entering it alive, by operating in an antiseptic atmosphere, in the form of a cloud of spray imbued with the acid. Richardson's spray apparatus, as suggested for ether, with a solution of acid one to forty, answering every purpose, while the sponges are rendered harmless by wringing them out of a watery solution, the fingers of the surgeon and his assistant having been dipped in the same, and the saw and other instruments smeared with oil containing a tenth part of the agent. When the spray is efficient a weaker solution may be used for sponges, fingers, &c., one part of the acid to a hundred of water; whereas if the spray is not used I do not feel justified in recommending anything weaker than one to forty. The wound must be covered with a cloth dipped in the lotion during any periods of suspension of the spray, which should, with such exceptions, be continued throughout the entire process, in-

cluding the securing of the vessels and the introduction of the stitches." (Lister.)

Lister advises also the use of catgut ligatures or sutures, prepared by steeping them for about two months in an emulsion made by mixing one part of crystallized carbolic acid, deliquesced by means of water, with five parts of olive oil, this emulsion being kept in a jar with a perforated diaphragm supported a little from the bottom of the jar, in order that the gut may rest upon it in the oil, the water subsiding. He says it is as safe as any ligature, and does not act as a foreign body in the wound, the ends being absorbed. He has never known secondary hemorrhage to follow its use; it is superior to wire. During the insertion of the sutures the spray is to be employed.

"At the completion of the operation it remains to carry out the other division of the antiseptic treatment, viz., to apply such an external dressing as shall securely guard for the future against the penetration of septic fermentations from without.

"For this purpose the most convenient material I have yet arrived at is the antiseptic gauze, made by impregnating a cotton cloth of open texture with a mixture of carbolic acid one part, resin five parts, paraffin seven parts, in which the resin serves as a vehicle for the acid, while paraffin is added to prevent inconvenient adhesiveness."

This dressing, while it absorbs discharge, holds the antiseptic securely lodged in its fibres, where it is retained by the insoluble resin, and it is to this circumstance that it owes its superiority over most other porous applications. It is wrapped round the stump in about eight layers, and during the first few days, while there is a copious effusion of serum, it is well to surround it with some impermeable tissue, to prevent the discharge from passing directly outwards, and compel it to travel along the whole extent of the antiseptic investment, which should reach several inches up the stump. The gauze is also extremely useful in the form of antiseptic bandages, whether to check a tendency to retraction of the soft parts of a stump or for securing and completing a dressing. If strapping is required, common adhesive plaster may be rendered antiseptic by dipping it for a second or two in a watery solution of the acid, and it is most convenient to have the lotion hot, so that the strap is warmed at the same time by its immersion. It can then be applied effectively under the spray, which should always be used in changing the dressings of a stump, till the wound has become superficial. The antiseptic atmosphere not only affords perfect security against the introduction of mischief, which it would otherwise be extremely difficult to avoid, but has the great advantage of permitting free inspection and manipulation of the stump. When the spray is intermitted, the wound must be covered with a "guard of rag dipped in the lotion. The ends of the adhesive straps should be overlapped by the gauze, to prevent them from subsequently conducting putrefaction inwards. While discharge is free, the dressings should be changed daily; but as it diminishes, the intervals may be increased, till when there are merely a few minims in twenty-four hours the gauze may be left undisturbed for a week together."

"Besides these antiseptic precautions, there are two other points essential to bear in mind in carrying out the treatment, viz., to provide for the due escape of serum, and to protect healing parts from the irritating influence of the antiseptic gauze. For the first purpose I have found it convenient to lay in the wound a strip of lint soaked with an oily solution of carbolic acid (1 to 10), one end hanging out as a drainer, this being removed on the second day after the operation under the spray. For the second purpose it is necessary to protect the cicatrizing part by interposing between it and

the gauze a layer of oil-silk coated on both sides with copal varnish, and afterwards brushed over with dextrine to enable it to become uniformly moistened when dipped into a watery solution. It is thus immersed just before being laid upon the wound, the dressing of the wound consisting of an antiseptic to keep out putrefaction, and an unstimulating protective to exclude the antiseptic."

"This practice," writes Lister, "will be found by no means difficult or complicated. It requires no special skill, and the care which it is essential to take soon becomes habitual and instructive, and in the aggregate saves the surgeon a great deal of time, besides relieving him of a load of anxiety. For when a few days have passed without putrefaction, the dressings may be left unchanged for several days together, while at the same time the patient is felt to be absolutely secure against the various risks of pyæmia, erysipelas, hospital gangrene, necrosis, osteo-myelitis, or exhaustion from profuse suppuration."

"Surely," sums up Lister, "these are advantages well worthy of our best efforts to attain them," and in this I cordially agree; but more experience is wanted before these advantages that Lister claims for it are established. I am no convert as yet to the theory upon which it is based, nor to the great value of the special practice based upon it; neither is yet proved.

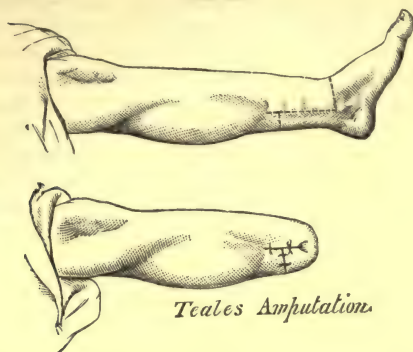
I have given the practice in the words of the distinguished originator, feeling that if it had no other influence to back it than Professor Lister's name and authority it ought to have a fair trial and be honestly tested.

Teale's Amputation, a modification of the Skin and Muscular Flap.—This was introduced "to procure a more useful stump, and in the hope of somewhat diminishing the mortality of the operation. It is proposed to amputate by a long and a short rectangular flap, the long flap folding over the end of the bone being formed of parts generally devoid of large blood-vessels and nerves, whilst those important structures are contained in the short flap. The size of the long flap is determined by the circumference of the limb at the place of amputation, its length and its breadth being each equal to half the circumference. The long flap is, therefore, a perfect square, and is long enough to fall easily over the end of the bone. In selecting the structures for its formation, such parts must be taken as do not contain the larger bloodvessels and nerves. A flap so formed will be, for the most part, anterior in position, as far as regards the general aspect of the body, but superior when the patient is in the recumbent position, as during the after-treatment. The short flap, containing the chief vessels and nerves, is, in length, one-fourth of the other (Fig. 483). The flaps being formed, the bone sawn, and the arteries tied (twisted), the long flap is folded over the end of the bone; each of its free angles is then fixed by suture to the corresponding free angle of the short flap. One or two more sutures complete the transverse line of union of the flaps. At each side the short flap is united to the corresponding portion of the long one by a point of suture, and the suture then unites the reflected portions of the long flap to its unreflected portion. Thus, the transverse line of union is bounded at each end by a short lateral line at right angles to it."

In making this long anterior flap, more particularly when it is chiefly skin, as in the leg, the surgeon should be careful not to scarify it with his knife, for, on account of its length, it is very prone to slough, and if scarified this tendency is increased; indeed, this sloughing of the long flap is the great disadvantage of the operation, for in an ordinary thigh, twelve inches in circumference, a flap of six inches would have to be made. To secure a cicatrix away from the extremity of a stump is a point of great practical value, and to do so by a long anterior flap is, doubtless, an advantage; but

this often requires more soft parts than are generally at the surgeon's disposal, unless more of the limb than requires removal be taken away. This object may, however, sometimes be secured by making a shorter anterior

FIG. 483.

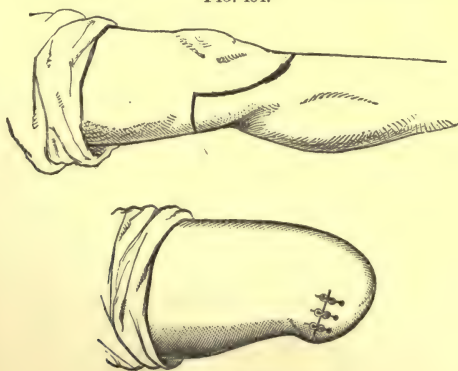


flap than Teale suggests, and dividing the bone one or two inches above the line of the skin flaps. In fact, as long as the anterior flap has sufficient length to be drawn over the end of the stump to its posterior aspect, whether rectangular or oval, the same principle is observed.

Mr. Spence, in his "Surgery," 1871, page 749, tells us that he acted much upon this principle in 1858, making one long *anterior skin and muscular flap*, with a short posterior, clearing the bone for nearly two inches before dividing it.

The Mixed Form of Amputation.—This line of thought, however, leads to what is now known as *Carden's operation*, or to—a somewhat better term—the "*mixed form of amputation*," for Carden's operation, in principle,

FIG. 484.



From Carden's.

includes a skin flap and circular division of muscle, a combination of the two forms—that of the circular and the flap—already described.

"The operation consists in reflecting a rounded or semi-oval flap of skin and fat from the front of the joint (knee), dividing everything else straight down to the bone, and sawing the bone slightly above the plane of the muscles, thus forming a flat-faced stump with a bonnet of integument to

fall over it. The operation is simple. The operator, standing on the *right* side of the limb, seizes it between his left forefinger and thumb at the spot selected for the base of the flap, and enters the point of the knife close to his finger, bringing it round through skin and fat below the patella to the spot pressed by his thumb, then, turning the edge downwards at a right angle with the line of the limb, he passes it through to the spot where it first entered, cutting outwards through everything behind the bone. The flap is then reflected, and the remainder of the soft parts divided straight down to the bone; the muscles are then slightly cleared upwards, and the saw is applied. Or the limb being held as before, the hand and knife may be brought round under the limb, as in the circular operation, and the blade entered near the thumb and drawn round to the opposite side, when the ham may be cut across by turning the edge of the knife upwards, and the operation completed as before. In amputating through the condyles the patella is drawn down by flexing the knee to a right angle before dividing the soft parts in front of the bone; or, if that be inconvenient, the patella may be reflected downwards." ("Brit. Med. Journal," April, 1864.)

This operation of Mr. Carden's is a very valuable one, not only as applicable to the knee-joint, to which it was originally applied, but on account of the principle of practice it embodies—that of making skin flaps and the circular division of the muscles; the practice was not, however, new, for Mr. Carden began it in 1846, the year that Mr. Syme published, in the "*Edin. Month. Jour. of Med. Science*," his modification of the circular method of amputation in the lower third of the thigh, by making two semi-lunar skin lateral flaps and oblique section of the muscles down to the bone, dissecting the skin flaps an inch or more upwards, and cutting the muscles on a level with the retracted skin. Liston also, in 1839, in muscular subjects, preferred skin flaps only.

Accepting it as an operation for the removal of a limb through the condyles of the femur, I have, however, found it advisable to make a slightly longer posterior flap than Carden advises, but a skin flap only, taking care to make the long anterior flap a good broad one, with a base corresponding to the posterior border of the lateral surfaces of the condyles.

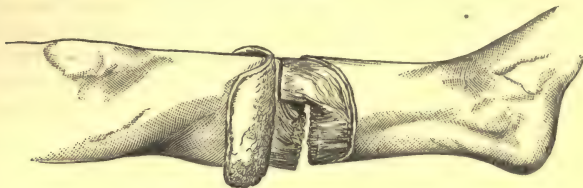
By this operation there is but a slight section of the muscular tissue, and beyond the popliteal artery few vessels of importance are divided. The stump that remains is a remarkably good one; it is long and broad, and patients can bear their weight upon it without pain. I believe this operation is applicable to a far larger number of cases than is generally believed, and, with Lister, look upon it as a great advance in surgery. It is, moreover, far safer than amputation through the shaft of the femur.

The object of all these long anterior flap operations is, however, the same; it is to procure a cicatrix that is placed out of harm's way, behind the stump; and so long as this end can be secured without taking away more of the body than is absolutely required by the disease, and not for the operation, the amputation is a good one; it being a matter of small importance whether the rectangular and muscular flaps of Teale, the convex skin flaps of Carden, or skin and muscle as practiced by Spence, be employed. I prefer Carden's flap, with the modifications described, better than any other, and when applied to the knee, where it is most applicable, look upon it with high favor.

This "mixed method of amputation" has, however, a wider application than to operations about the knee, for it includes the advantages of the circular and the flap without their disadvantages; indeed, I believe it to be by far the best operation in all amputations of the leg and forearm; by it there is rarely, if ever, any necessity to sacrifice more of the extremity than

is absolutely required. Two lateral skin flaps should be made sufficiently long to meet without stretching over the stump, the surgeon judging by his eye their required length, and the muscles should be divided by a circular sweep one inch below the base of the retracted flaps, the bones being bared to this extent before they are divided (Fig. 485). Mr. Cock includes the

FIG. 485.



Amputation of the leg by the mixed method.

muscles in the flap, but I hardly think this is necessary unless the skin be very thin. When the flaps are brought together a pretty stump is seen, and a very good one subsequently secured, the cicatrix much resembling that of the circular.

In amputation of the forearm the mixed form is *the* operation, the skin flaps being made from the anterior and posterior aspects of the part. It is far superior to the flap made by transfixion, the tendons of the part always rendering this method a very unsatisfactory one in this region (Fig. 490).

In amputation at the wrist-joint and elbow-joint nothing can be better (Figs. 488-9), the surgeon having it in his power, at all times when integument allows, to make one long anterior, posterior, or lateral flap to cover in the stump, and thus secure the cicatrix being out of harm's way. One of the best stumps of this kind I ever turned out was at the elbow-joint, making a long skin posterior flap, the cicatrix subsequently being placed above the condyles of the bone and in front (Fig. 489).

CHAPTER XCI.

SPECIAL AMPUTATIONS.

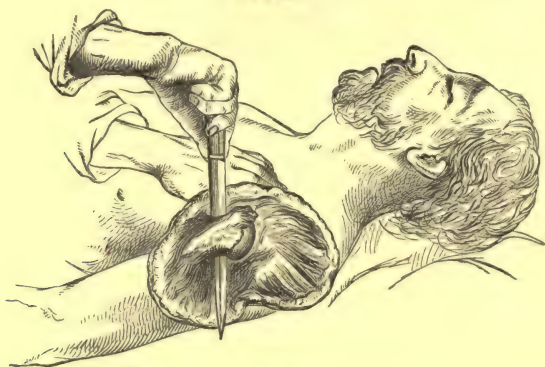
HAVING considered the subject of amputations as a whole, I propose now to consider it in detail as applicable to different parts of the body, and shall begin with the upper extremity.

In a general point of view amputations of the upper extremity are successful operations. Those of the shoulder-joint are the worst, about one case in three proving fatal after accidents and about one in two after disease. Amputations of the arm for disease generally do well except in the very old or feeble; for accident about one case in five terminates unfavorably. Amputations of the forearm are about equal in danger to those of the arm.

Amputations at the Shoulder-joint.—These are usually best performed by means of the double flap operation. A good assistant is required to

compress the subclavian artery above the clavicle, or to take charge of the axillary in the lower flap. When the right arm is the one to be amputated the surgeon should stand behind his patient, when the left arm, in front (Fig. 486), a deltoid flap should then be made, cutting from without inwards from one inch in front of the acromion process down to the posterior part of the axilla, including in its sweep the whole deltoid muscle. Having reflected this flap with a few bold sweeps of the knife, the head of the humerus is to be disarticulated, the knife being kept close to the bone, and the lower flap made by cutting from within outwards, this lower flap being about three or four inches long. If this part of the operation is done with care the main artery of the limb will only be divided on the completion of the second flap, and the surgeon can with his left hand secure it by

FIG. 486.



Amputation at the shoulder-joint.

pressing it between his finger and thumb until torsion or ligature forceps is obtained.

During the first step of this amputation the arm is to be held well out by an assistant, but during the second it is at first to be held near the body, and when the knife has passed beneath the head of the bone it should be abducted. A very good stump usually follows this operation. There is no joint of the body, however, at which the surgeon is more compelled to form his flaps according to the circumstances of the case than at the shoulder, for the majority of cases of amputation are for injury, where the arm has been wholly or partially torn off, and under these circumstances the surgeon must make the best flap he can; at times he may have no flap at all. As good a stump as I have made at this joint was one in which a piece of integument from the posterior part of the arm was alone available. I have seen many cases in which the flaps sloughed, and yet a good cicatrix followed, the soft parts being readily drawn forwards by the cicatricial process.

Some surgeons prefer an anterior and posterior flap, perforating in front of the posterior axillary fold and making the posterior flap first, disarticulating and dividing the axillary artery in the anterior flap. This is a good operation, but not so good as the former.

Amputation of the Arm.—The flap operation, as already described, is the best in this region, the anterior flap being made by cutting from without inwards towards the bone, excluding the brachial artery, and the pos-

terior by transfixing all that remains. In a very large muscular arm the skin flap and circular muscle or *mixed* operation may be performed. Amputating by double flaps and transfixion is, however, good (Fig. 487).

Amputation at the elbow-joint is a capital operation; it ought to be performed far oftener than it has been. No stump can be better than that

FIG. 487.

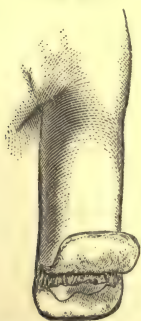


Amputation of arm by flap operation.

usually obtained, and, as in all other amputations at joints, there is less constitutional disturbance after the operation, and probably less risk to life. I have had a patient up and about on the seventh day after such an operation, the wound having united, no traumatic fever or other disturbance having followed the operation.

It should be performed by the mixed method of amputating, by anterior and posterior skin flaps, the muscles being divided transversely on completing the disarticulation (Fig. 488). In the drawing of the stump (Fig. 489) the posterior flap was made longer than the anterior, in order that the cicatrix might be out of harm's way. I have performed this operation

FIG. 488.



Amputation of elbow-joint by mixed method.

FIG. 489.



Stump after amputation at elbow-joint.

on four occasions, and the result in all was so good that I shall do it again as soon as an occasion necessitates. I cannot too strongly advocate this operation whenever the injury or disease will allow; it ought to be performed, in fact, whenever enough integument can be saved to cover the

bone, and the disease or injury for which amputation is called for has not attacked the humerus.

Amputation of the Forearm ought always to be performed by the mixed method of amputating; the one by perforating is a very unsatisfactory operation, the many tendons, &c., of the part causing very ragged flaps, and thus favoring suppuration. Two well-cut and fairly long skin flaps and a clean circular section of the muscles are far preferable to the flap operation, and yield a good stump (Fig. 490). The skin is usually too thin for one long skin flap, and there are too many tendons for a Teale's. The same operation is the best at the wrist-joint.

FIG. 490.

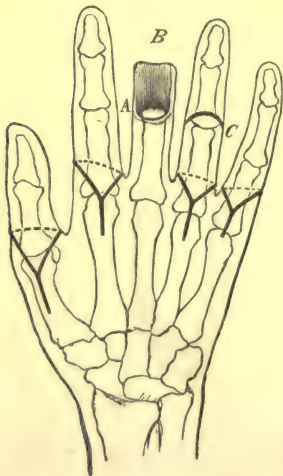


Amputation of forearm by mixed method.

Amputation of the Thumb and Fingers.—A knowledge of the shape of the articular ends of the bones and the position of the different articulations of the hand is of importance in all operations on these parts, and I have, therefore, given a figure illustrating these points as much as possible (Fig. 491).

The surgeon should remember that with the hand closed the knuckles are formed by the heads of the metacarpal bones, the bases of the phalanges being in front, and that in the second and third rows the same arrangement

FIG. 491.



holds good. To open any of these joints, consequently, the line of incision should be anterior to the knuckles on the dorsal aspect and in the fold of the fingers on the palmar. In the figure it will be observed also that the two distal joints are concave, with the concavity looking towards the ends of the fingers, while at the metacarpal joints the concavity points the other way, the heads of the metacarpal bones being round; from the palmar surface the metacarpo-phalangeal joints are at least half an inch behind the clefts of the fingers, corresponding pretty nearly with the palmar furrow of the hand, this furrow likewise corresponding with the upper limit of the synovial sheaths of the flexor tendons and bifurcation of the digital arteries.

In amputating at the phalangeal joints (Fig. 491, c) or in the bones in continuity, anterior and posterior semicircular flaps are better than the flap operation, although this may at times be performed with advantage, one long anterior

flap (B), after opening the joint from its dorsal aspect (A), being the most common shape, but the surgeon must in these cases be much guided by what skin he has to utilize to cover the bone. As a rule, it is wise not to take off the head of the proximal bone, but when there is not sufficient flap

to cover it the surgeon may be justified in removing its head with bone forceps.

Amputation of the fingers at their metacarpal joints requires much nicety, and in all the fingers the surgeon is to remember that he is on no account, unless absolutely required, to interfere with the palm of the hand; his incision in the palmar surface is never to go beyond the fold of the joint. In performing this operation the surgeon is to take charge of the amputated member, an assistant holding the hand, separating the fingers, and compressing the radial and ulnar vessels. With the hand pronated a vertical incision should be made about one inch long with a strong scalpel over the dorsal aspect of the head of the metacarpal bone, and from its distal end over the joint the knife should be made to pass up one cleft of the finger close to the bone to be removed, round the palmar surface of the finger in the fold, and through the second cleft to the point from which the circular incision started, the tendons and ligaments being divided as cleanly as possible (Fig. 491). The joint is then to be opened and the finger removed. In a laboring man it is wise not to remove the head of the metacarpal bone unless diseased; in the higher classes it is sometimes expedient to take it away with bone forceps, to allow the neighboring fingers to be brought closer together, and thus improve the aspect of the hand. With the same object it is at times wise to take off the head of the metacarpal bone of the little or index finger obliquely away from the median line of the hand. In amputating the little finger or index finger at this joint the same form of incision may be made, the outer flaps under both circumstances being made somewhat larger than the inner, in order that the cicatrix may be placed close to the adjoining finger, and thus out of all harm's way. To so plan the incision as to allow the scar to fall over the exposed aspect of the hand is very inconvenient, and often painful, the hand naturally resting on its outer borders.

The same arguments apply to the *amputation of the thumb*, one long external skin flap adjusted to a shorter flap in the cleft being far superior to the palmar and dorsal flaps usually adopted. But it may be here stated that amputation of the thumb ought to be a very rare operation, it being far better practice in all cases of injury to the thumb, where there is no possibility of saving it, simply to cut off any sharp point of bone, trim up the soft parts, and allow the stump to granulate, than make what is sometimes called a good job of it and amputate the organ higher up; for any stump of a thumb, however short or ugly, is of use. In the hand figured below (Fig. 492) the man was an engineer, and he has been able for years to follow his occupation with but little inconvenience.

FIG. 492.



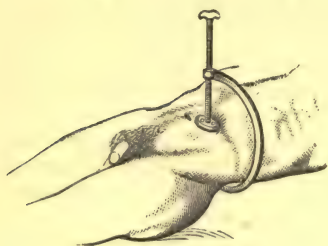
To describe other amputations of different parts of the hand is unnecessary; as little as possible is always to be taken away, and this is to be done by making skin flaps only, care being always observed to divide the tendons by a clean cut, and as high up as possible. The ingenuity of the surgeon and the wants of the individual case will suggest the best means by which the latter can be supplied.

Amputations of the lower extremity.—These are of more importance than those of the upper, from their greater severity. They are larger operations, and are more dangerous; they are possibly more difficult.

Amputation of the thigh at the hip-joint is a formidable operation.

When performed for accident it is almost always fatal, not ten per cent. recovering; for disease it is more successful, the risk being about at par. The best flaps appear to be the external and internal. The patient being brought to the edge of the table, with the tuberosities of the ischium in view, Lister's valuable abdominal tourniquet is to be adjusted (Fig. 493), and when the patient is under chloroform and everything is prepared, screwed up. The surgeon should then make the external skin flap by means of a semicircular incision, starting from the tuberosity of the ischium, downwards and outwards one hand's breadth below the great trochanter, and then upwards and forwards to the centre of the groin on the outer side of the femoral vessels, and this should then be reflected upwards above the trochanter so as to expose it and allow the joint to be opened and disarticulation to be completed, the limb being forcibly adducted by

FIG. 493.



Lister's abdominal tourniquet.

FIG. 494.



Amputation at hip-joint. External and internal flap.

an assistant to facilitate this step. In doing this no vessels of any importance are opened while the most difficult part of the operation is completed.

The inner flap now remains to be made, and this is readily done by transfixing the thigh on the inner side, inserting the knife (twelve inches long) in the anterior wound, passing it backwards close to the inner side of the neck of the femur, and bringing it out near the tuberosity of the ischium where the external incision was commenced, and then cutting out through the soft parts, including all the adductors, &c. (Fig. 494.) In doing this all the pelvic muscles are separated at one clean sweep from the thigh-bone, and a few touches of the knife completes the amputation. Should there be much fear of loss of blood the common femoral artery may be ligatured in the wound before the second flap is made, or it may be divided and twisted. The vessels are then to be secured in the way the surgeon proposes, and the parts brought together, the two flaps usually forming an excellent covering to the pelvic cup; the wound is a vertical one, and therefore good for drainage and a good scar results.

This operation I believe to be a better one than the anterior and posterior flap usually advised, and which is thus described by Erichsen: "If the operation be on the left side, the knife (twelve inches long) should be entered about two fingers' breadth below the anterior spine of the ilium, and carried deeply in the limb behind the vessels directly across the joint,

its point being made to issue just above the tuberosity of the ischium. In transfixing on this side care must be taken not to wound the scrotum or the opposite thigh; the back of the knife must run parallel to, but not against, the pelvis, and the point must not be held too high, lest it enter the obturator foramen. The anterior flap must then be rapidly cut downwards and forwards about five inches in length. The limb must now be forcibly abducted and everted, the capsule of the joint opened. So soon as this is done, the head of the femur must be pushed up by forcibly depressing and abducting the limb, so that it may start out of the acetabulum; the heel of the knife is then passed behind it, the remainder of the capsule cut across, and the posterior flap rapidly fashioned by carrying the knife downwards and backwards through the thick muscles in this situation; the posterior flap may be about four inches long." The operation is then to be completed as the former. In both these operations good assistants are needed to compress any bleeding vessels as they are divided, for hemorrhage and the shock of the operation are the great fears. Lister's compressor has, however, rendered this serious operation a safer one than it was.

Amputation of the thigh in the upper or middle third, when the muscles are thick, is best performed by anterior and posterior skin flaps and circular muscle, or by the flap operation as illustrated in Fig. 480, the anterior flap being made by cutting from without inwards, and the posterior by perforating. The lateral flaps, whether made of skin and muscle, or skin alone and circular muscle, is not a satisfactory operation, the bones having a tendency to appear between the flaps at the upper angle. In amputation in the lower third one long anterior flap may be made, and a short posterior, as previously described under Carden's operation (page 950).

In amputation through the condyles and at the knee a long anterior skin flap, and shorter, but not short, posterior skin flap, should be made by cutting from without inwards, the muscles being divided by the circular sweep of the knife in disarticulating.

The patella need not always be removed; when diseased it should be, but not otherwise; on three occasions I never saw the bone when I amputated at the joint, and excellent stumps resulted. I know of no stump so good as that which follows an amputation at the knee-joint (Fig. 495). The condyloid operation is good, but less satisfactory.

In amputation of the thigh for *chronic joint disease*, at all ages, the mortality is about 1 in 4, but under the age of twenty it is about 1 in 17, while over that period it is about 1 in 3, the difference in the mortality of the operation at the two periods being very great. Thus, taking all cases of chronic disease together, out of 89 cases of my own, 13 died; of 99 of Callender's, 28; of 54 of MacCormac's ("Dublin Journal," 1868), 10 died; and of 106 of Holmes's, 30 died; making a total of 348 cases, of which 81 died, or 1 in 4. In subjects under twenty years of age, out of 69 cases of Callender's and my own, 4 died, or 1 in 17; and of 119 cases over twenty years of age, 38 died, or 1 in 3; amputation of the thigh for chronic joint disease being six times more successful in early life than in middle age. *Primary* amputations of the thigh prove fatal in about 60 per cent. of all cases, or in more than half; and *secondary* in the proportion of 75 per cent. or in 3 cases out of 4. In amputations of *expediency* the mortality is about 1 in every 3 cases.

FIG. 495.



Stump after amputation at the knee-joint.

Amputations in the upper third of the thigh are nearly as fatal as those of the hip. Amputations in the middle third are far more successful; those in the lower third are still better, and amputation through the condyles or at the knee-joint are the best. Amputations at the knee-joint are very good. Pollock (*"Med.-Chir. Trans.,"* 1870) gives 48 cases operated upon in England, with 12 deaths. I have performed this operation seven or eight times with success; one case I lost from pyæmia. There is less traumatic fever after this operation than any other of equal magnitude.

The statistics of military surgeons have well proved these points, and in civil practice it is well to bear the truth in mind that the danger of an amputation is increased by every inch of bone removed.

Amputation of the Leg in the upper two-thirds is, doubtless, best performed by the mixed method, by two skin lateral flaps and the circular division of the muscles, as already described (Fig. 485). When the condition of the soft parts forbids such an operation other flaps may be made, any form being allowable rather than sacrificing more of the limb than is necessary. In the lower third, doubtless, Teale's amputation is a good one, the long anterior flap not being too long or so liable to slough. The long muscular flaps, and more particularly the posterior calf flap, are not to be recommended. In the lateral flap operation Mr. Cock, who always includes the muscles, turns out excellent stumps. He always makes the flaps long. Some surgeons, in this mixed method, make anterior and posterior skin flaps. They are not so easily made as the lateral; and the anterior flap, falling over the edge of the tibia, is apt to slough, or to form unpleasant adhesions. In dividing the tibia, its anterior edge may be rounded off with the saw; by doing this there is less chance of the skin on it ulcerating or sloughing.

Amputation of the leg for disease is a very successful operation, about one case in twelve only proving fatal. In young life it is more successful than at a later period.

Amputations for injury are, however, very unsuccessful, at least 60 per cent. or more than half the cases, dying; pyæmia is a more common cause of death after this form of amputation than even after that of the thigh, it being fairly proved that the larger the section of the shaft of a bone the greater the liability there is to blood-poisoning.

Amputations of expediency in the leg are as dangerous as are those for injury.

Amputation of the Foot.—In no part of the body has an improved surgery shown to greater advantage than in the foot, for in none has so much been done in the way of conservatism. Where formerly amputation of the whole foot was a common operation, we have now Hey's, Chopart's, Syme's, Pirogoff's, the subastragaloid, and Hancock's operations, all being based upon the well-established position that governs, or ought to govern, all amputations—that no more of the body should be removed than the necessities of the individual case require, or, in other words, upon the principle of "the least sacrifice of parts." To amputate a foot where anything less would suffice, in the present age, is regarded as almost criminal, and surgeons generally accept Hancock's well-put question, in his valuable lectures at the College in 1866, when he said, "Can anything be more unphilosophical than to advocate the sacrifice of any bone or joint of the foot for no other reason than that a particular operation should be performed?" (*"Lancet,"* 1866.) Indeed, this principle of practice should be uppermost in the mind of every surgeon when called upon to treat any local disease; in the hand and foot it should be so pre-eminently. Accepting it, therefore, there will be no difficulty in accepting Hancock's three other dicta:

That we should perform our operation as close to the disease or damaged structure, and preserve as much of the foot as we possibly can do with safety to our patient.

That, where practicable, we should cut through the tarsal bones with a saw in preference to disarticulating them.

That we should avoid the destruction of joints whenever we can do so.

These views of Hancock accord so closely with my own that I have given them in his words, and have placed them as leading principles in the surgery of the foot; they accord entirely with those I have attempted to lay down as guides to the surgeon in the surgery of other parts of the body. I believe them to be no less of scientific than of practical value, and I would wish the student to have them always before him in the treatment of every case of local injury or disease.

Indeed, it is upon this principle of practice now described—that of “*the least possible sacrifice of parts*”—most of the operations of the foot are undertaken, and it is well to remember that of the different amputations that have been recommended each succeeding one is only a degree more severe than the preceding, and that none of them are called for until minor measures have altogether failed. For the surgeon in the present day takes away diseased bone or bones without fear, leaving nature to repair the breach, and in this confidence he is rarely deceived. Upon this principle I have taken away in one case the whole second row of tarsal bones; in another the three cuneiform, scaphoid and cuboid; in both cases, with an excellent result. I have removed the necrosed os calcis with so little deformity as to be almost incapable of detection, and recently have taken away the upper articulating surface of the astragalus for disease with a result which has astonished me, no external deformity remaining, and almost complete movement of the ankle. Mr. Key in 1836 took away the whole of the outer part of the foot for injury from a boy, æt. 17, leaving only the os calcis, astragalus, scaphoid, inner cuneiform bone, and great toe (*vide* Fig. 496, “*Guy’s Rep.*,” 1836), the boy subsequently had a useful and sound foot. More recently my colleague, Mr. Birkett, has done the same with a like success. Single metatarsal and tarsal bones may be removed when irreparably diseased with some confidence of a good result, and any of the operations I am about to describe are only to be undertaken when less severe measures are out of court.

Upon this principle the amputations of Hey and of Lisfranc were hailed with satisfaction, Lisfranc’s consisting of the disarticulation of the metatarsal bones from the tarsal, Hey suggesting the same thing, or the section with the saw of the metatarsal bones. Chopart’s amputation, again, at the medio-tarsal joints, and Syme’s amputation at the ankle-joint, or Pirogoff’s, a modification of this, in which part of the os calcis is preserved, all have the same end in view. The subastragaloid amputation, as recorded by Malgaigne, was based upon the same principle, its object being to save the astragalus and ankle-joint, Hancock’s amputation going still further in the way of conservatism, to save the posterior part of the os calcis with the astragalus.

All these operations have their own value; they are applicable in a different class of cases. Where the minor measure will suffice, the major is out of all question, the principle, as I have said, of the least possible sacri-

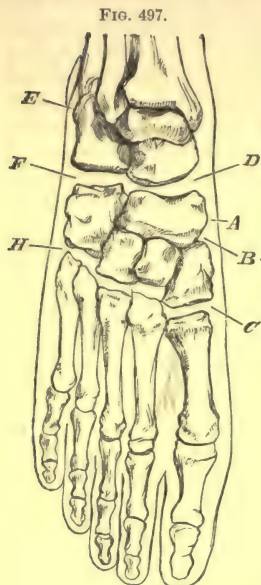
FIG. 496.



Key's case. "Guy's Hosp. Rep.," 1836.

fice of parts being the one upon which they, as all other amputations, should be based.

Before considering the different forms of amputation it will be well, however, to consider briefly the surgical guides to the foot as expressed by its anatomy, for although in cases of disease these guides are greatly obscured, they are still of value, and in cases of injury they are always reliable. The accompanying figure will help the student.



On the *inner* side of the foot, not far from the inner malleolus, the tubercle of the scaphoid (A) is to be felt as a marked prominence; about half an inch in *front* of this will be found the articulation with the cuneiform bone (B), and one inch beyond this the joint which the surgeon will have to open in Lisfranc's or Hey's operation (C); just above the tubercle of the scaphoid will be found the articulation with the astragalus, the line of Chopart's amputation (D).

On the *outer* side of the foot, one inch below the external malleolus, a sharply defined projection will always be felt, which is the peroneal tubercle (E), and half an inch in front of this will be found the joint which separates the os calcis from the cuboid, this joint forming the outer guide to Chopart's amputation. Half an inch in front of this again, or one inch from the tubercle, the prominence of the fifth metatarsal

bone is always to be felt (H), the line above this prominence indicating the articulation with the cuboid bone, which forms the outer boundary of the incision for Lisfranc's operation.

All these points should be looked for in the healthy foot, and learnt, so as to be readily recognized in the injured or diseased.

Lisfranc's amputation consists in the removal of all the toes with the metatarsal bones by disarticulation. **Hey** did this also; but when possible he saved the joints and as much of the metatarsal bones as he could by sawing through them. In this way he simplified the operation, for the second metatarsal bone being longer than the first and third, for articulation with the middle cuneiform, is difficult to disarticulate.

"The operator," writes Malgaigne, in describing it, "should use a small knife with a solid strong back, and only one edge. In operating on the right foot the patient should lie on his back, and the surgeon, facing the foot, grasp it with his left hand, the thumb and finger respectively resting on the well-marked bony projection of the metatarsal bone of the little toe, and the base of that of the great toe placed one inch in front of the tubercle of the scaphoid. Half an inch in front of these points an incision with its convexity downwards is to be made across the dorsal aspect of the foot, dividing all the soft parts down to the bones by a second cut. The plantar flap is then to be made by two lateral incisions carried from the base of the dorsal flap along the metatarsal bones, and joined by a curved incision made on a line beyond the ball of the great toe. This flap is to be longer on the inner than on the outer side, because the internal cuneiform bone is thicker than the cuboid, and it is to include all the tissues down to the bones. Disarticulation has next to be performed, and this is the best done from the dorsal region, when the parts are put firmly on the

stretch by depressing the toes. The operator then places the point of the knife on the outside of the joint, and carrying its edge inwards he opens it as far as the third metatarsal bone. Around here he carries the knife half a line forwards, incises almost transversely, and thus reaches the second metatarsal. Here he must, above all things, remember the general precept, not to engage his knife in the joint, but to work only with its point, and to confine himself to the division of the ligaments. When this instrument has reached the second metatarsal bone, he quits this side of the articulation to attack the inner side. This is well done by inserting the knife between the shafts of the first and second metatarsal bones, with its edge upwards, and with a backward and forward motion dividing the ligaments holding the second bone in place, this fact being indicated by the sudden loss of resistance which the left hand of the surgeon feels when pressing the toes downwards, and sudden separation of the tarsus from the metatarsus. Disarticulation is then to be completed with the plantar flap by cutting forwards close to the bone. A long dorsal flap may be made when the plantar flap must be short."

The parts are then to be brought together by sutures, after securing the vessels by torsion or the ligature and cutting off ragged tendons, the foot being fixed upon a splint, with the leg semiflexed upon its outer side, and treated on ordinary principles.

In Hey's operation the same incisions are called for, but no disarticulation, the surgeon dividing the bones as far forwards as the disease or injury allows. It is far easier than Lisfranc's, and as successful in the right cases. Both operations are, however, but rarely called for; though when all the toes require amputation Hey's is the operation to be performed.

Chopart's amputation is an excellent and valuable operation; it should always be performed in preference to any higher measure, when disease or injury is confined to the forepart of the foot. The great theoretical objection brought against it—the subsequent drawing up of the heel and the consequent pointing of the stump—has really little weight, for it can be provided against by the division of the tendo Achillis at the time of the operation, or subsequently, should the difficulty occur. My colleague Mr. Cock thinks most highly of this operation. He has done it many times, and has never had to amputate subsequently on account of the pointing of the stump. He says that this can always be prevented or cured by the division of the tendo Achillis on the first indication of such a malformation. It was introduced into English practice in 1828 by the late Mr. James, of Exeter, and to the notice of Scotch surgeons by Professor Syme, who subsequently, however, gave it up in favor of his own operation at the ankle-joint. He did so by reason of the objection stated, and because in such partial amputations the part of the tarsus left behind, though apparently sound at the time, may become affected with the same disease at a later period. But such an argument may be brought against all operations less than the removal of a diseased part far from the seat of mischief, and is now fairly repudiated by modern surgeons. In fact all excisional and conservative surgery is based upon an opposite supposition, the local nature of disease becoming daily more acknowledged and acted upon.

The operation may be described as the amputation of the forepart of the foot, anterior to the astragalus and os calcis, or as the mediotarsal amputation. On the right foot it is to be commenced by making a slightly convex flap from the dorsal aspect of the foot, commencing one inch behind the prominence of the metatarsal bone of the little toe, and terminating behind the tubercle of the scaphoid, the surgeon grasping the foot, with his index

finger on one point and his thumb on the other. The skin is the first part to be divided, and subsequently on the level of its retraction all the tendons,

FIG. 498.



Chopart's amputation.

&c., are to be cut through down to the bones or required joints, the articulations being opened, beginning at the scaphoid joint; the foot should be forcibly bent downwards, to facilitate this part of the operation; the plantar flap is to be made by cutting forwards, and in doing this care should be observed to keep the knife close to the bones on the sole of the foot, to divide the soft parts with as clean a cut as possible, making a good long flap, at least as long as the balls of the toes, and longer on its inner

than outer aspect (Fig. 498). All ragged tendons may be cut off short, and the parts brought together. Should there be any difficulty in bringing up the forepart of the stump, or any retraction of the heel, the tendo Achillis should be divided at once, but if no such difficulty is experienced such a measure is unnecessary. In dressing the stump a good opening for drainage should be left.

On one occasion I performed this mediotarsal operation for injury, making two lateral flaps from the dorsum and sides of the foot, the integument of the sole having been destroyed. A good stump followed.

Subastragaloid amputation comes next in order in the amputations of the foot, for it means the removal from the body of as much as Chopart's, with the addition of the os calcis. It should be performed when the disease for which an operation is required involves these parts, and yet leaves the astragalus and ankle-joint sound. It seems, according to Velpeau (*"Operative Surgery,"* 1839), to have been first performed by M. De Lignerolles, and subsequently by Textor, although Malgaigne in 1846 described the operation as his without mentioning these facts.

It is made by a heel flap, as in Syme's amputation, and a dorsal flap, as in Chopart's, the foot being removed by opening the joints between the scaphoid and astragalus, and disarticulating between this latter bone and the calcis. It is said to make a good stump.

"The stump resulting from the subastragaloid amputation appears to me," writes Hancock, "to be perfect; it is round, and of good form; the cicatrix is firm, and well up in front, and the bottom of the stump is perfectly covered by the natural heel tissue." Nélaton says this form of amputation "has been found to surpass all amputations." (*"Clin. Surg."*)

Hancock's operation must be looked upon as a modification of the subastragaloid, in the same way as Pirogoff's is a modification of Syme's, for Hancock saves the tuberosity of the os calcis, and turns it up to be united to the lower surface of the astragalus, from which he takes a slice of bone. It may be adopted when the surgeon in his attempt to perform the subastragaloid operation finds the lower surface of the astragalus diseased and the os calcis sound. Mr. Hancock performed the operation in 1864, and with an excellent result. In cases adapted for it this operation claims the surgeon's attention. The incisions are very similar to those required in the subastragaloid, the end of the os calcis being divided in a line corresponding to the heel flap, instead of the flap being reflected. In the "*Lancet*"

for 1866 full particulars of Hancock's operation may be read, as described by him in a lecture at the College of Surgeons.

Syme's operation consists in the removal of the whole foot at the ankle-joint, taking off the articular surfaces of the bones of the leg above the basis of the malleoli, a covering for the osseous surfaces being provided from the integument of the heel; the result being, adds Lister, "a stump admirably fitted for bearing the weight of the body. At the same time the parts likely to originate carious disease are completely got rid of; so that this operation is calculated to supersede entirely that of Chopart, besides taking the place of amputation of the leg in the majority of cases formerly supposed to demand it." ("Holmes's Syst.," vol. v, ed. 2.)

This view of the operation, which was held by its originator, emanating as it does from one who was so closely connected with Syme professionally and otherwise, is doubtless far too sanguine.

That it is a good operation no surgeon will deny when amputation of the whole foot is called for; but to say that it will supersede entirely Chopart's operation I trust will never be true, for where Chopart's amputation is good Syme's ought not to be entertained. When the bones of the ankle-joint and the joint itself are sound no surgeon ought to take the whole foot away when any minor measure will suffice. As an amputation of the foot, where the whole foot must be sacrificed, it is an admirable operation, but under no other circumstances can it be recommended; that it is superior to amputation of the leg most surgeons will admit, upon the same principle that Chopart's is superior to it—the principle of the least possible sacrifice of parts.

That it is a successful operation is always admitted, Hancock reporting ("Lancet," 1866) that out of 219 cases only 17 died, or $7\frac{1}{2}$ per cent.; 181 were operations for disease, and of these 11 died, or $6\frac{1}{2}$ per cent.; 32 for accident, of which 6 died, or 19 per cent.

The experience of the American war speaks also in its favor, for out of 67 cases only 9 died, or $13\frac{1}{2}$ per cent.

The operation is to be performed as follows. I give it in Syme's own words: "The foot being held at a right angle to the leg, the point of a common straight bistoury should be introduced immediately below the fibula, at the centre of its malleolar projection, and then carried across the integuments of the sole in a straight line to the same level on the opposite side. The operator, having next placed the fingers of his left hand upon the heel, and inserted the point of the thumb into the incision, pushes in the knife with its blade parallel to the bone, and cuts close to the osseous surface, at the same time pressing the flap backwards until the tuberosity is fairly turned, when, joining the two extremities of the first incision by a transverse one across the instep, he opens the joint, and, carrying his knife downwards on each side of the astragalus, divides the lateral ligaments so as to complete the disarticulation. Lastly, the knife is drawn round the extremities of the tibia and fibula, so as to expose them sufficiently for being grasped in the hand and removed by the saw. After the vessels have been tied (twisted), and before the edges of the wound are stitched together, an opening should be made through the posterior part of the flap where it is thinnest, to afford a dependent drain for the matter, as there must always be too much blood retained in the cavity to permit of union by the first intention. The dressings should be of the lightest description." "That the flap may and probably will still occasionally slough is unhappily too true; but this result is always owing to an error in the mode of performance; for as the integument, being detached from its subjacent connections, can derive nourishment only from the anastomosing of vessels, it

is evident that, if scored crossways, instead of being separated by cutting parallel to the surface, the flap must lose its vitality."

In Syme's first operation, in 1842 ("Observations in Clinical Surgery," 1861), he simply took away the malleolar projections, and did not remove the articulating surface of the tibia, as subsequently advised, but it is an open question whether any advantage is gained by this extra section of bone.

The stump following the amputation is excellent. Fig. 499, taken from Fergusson's lectures on the progress of surgery, illustrates it well: "The very bit of soft material on which we naturally stand is still preserved for the future basis of this support." (Fergusson.)

Some surgeons, and Pirrie amongst them, perform the operation without disarticulating the foot, sawing through the tibia and fibula without. The modification is a good one.

Roux's amputation differs from Syme's only in the flap being made from the inner and under side of the heel.

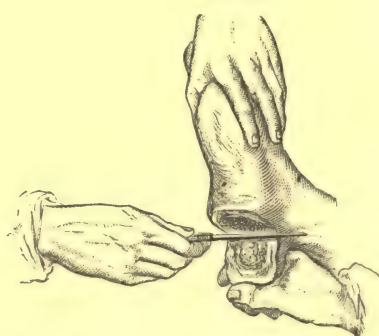
Pirogoff's amputation is a modification of Syme's; it was introduced by its distinguished originator during the Crimean war, and the merit he claims

FIG. 499.



Stump after Syme's
amputation, from
Fergusson.

FIG. 500.



Pirogoff's amputation. Heel flap with calcus.

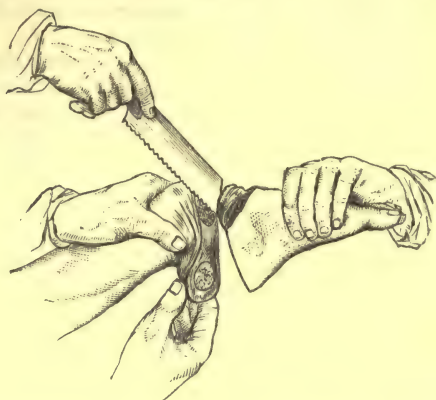
for his operation is the novel osteo-plastic principle that, a portion of one bone remaining, naturally connected with soft parts, readily unites with another, and at the same time serves to lengthen the limb and increase its utility. Our own Busk was the first surgeon who did it in this country in 1857. It differs only from Syme's in leaving the tuberosity of the os calcis in the heel flap instead of dissecting it out, and bringing up its exposed cut surface to unite to the divided extremities of the tibia and fibula. I have performed it on five different occasions, and in all with an admirable result.

The limb is longer than after Syme's amputation, and the stump is not to be excelled (Fig. 502). Patients can walk upon it as well as if no amputation had been performed. The incisions are the same as in Syme's, but no heel flap is dissected up. After disarticulating and dividing the lateral ligament sufficiently far for the os calcis to become visible behind the astragalus, the surgeon is to saw through the os calcis in the line of the heel, and remove the foot, taking off, subsequently, the ends of the tibia and fibula.

Dr. Eben Watson, after having made the heel flap, prefers to saw off as much of the os calcis as he wants to save before going further; but there

is an objection to this practice, for I have known the incision through the bone to be made too far forward into the astragalo-calcanean joint, and a second slice have to be removed. Dr. Watson adopts, also, Pirrie's practice of dividing the tibia and fibula without previous disarticulation of the foot (Figs. 500 and 501).

FIG. 501.



Pirogoff's amputation. Division of malleoli. T. Smith.

When this method is employed the surgeon should make a more oblique section of the os calcis from below backwards.

I look upon Pirogoff's amputation as a very excellent one; it ought always to be preferred to Syme's when the os calcis is sound. Should the bone be found to be bad at the time of the operation it must be taken away, the operation being made into a Syme's; but when the bone is good it appears to be a grave error to take away what makes so good a point of support to the body.

Hancock records fifty-eight cases of this operation, as performed by British surgeons. Five only died, or nine per cent.

Amputation of the toes may be performed in the same way as that of the fingers before described, equal care being observed not to interfere with the plantar surface of the foot. In amputating the great or little toes the same form of flaps should be made as have been recommended in amputation of the thumb and little finger; they should always be large, as much skin being saved as the case will allow.

Stumps, and their Morbid Conditions.—A good stump is a desirable thing to secure, although in no operation of amputation is it of such importance as to justify any increased risk to life being incurred in obtaining it: many of the most promising stumps after an amputation often turn out badly, and the least promising well; the result more probably depends upon their subsequent dressing than on the condition of the flaps at the time, it being quite certain that bad dressing may destroy the best stumps and good dressing make bad ones good.

A conical stump is always regarded as a bad one, and yet most thigh and arm (single bone) stumps become conical by time, the soft parts and muscles wasting, except in very fat subjects. When double bones exist this evil is rarely seen, nor in amputations at joints. Knee- and elbow-joint stumps with Pirogoff's are the best we see.

A stump that looks well after an operation, with a mass of muscle covering it in, will undergo a change; the muscles degenerate, the muscular fibres losing much of their characteristic features, and turning into fibro-cellular tissue, and when fat is deposited in this tissue a good stump is left. The end of the bone will become rounded off, and its medullary canal filled up; the nerves of the stump will be to a degree bulbous, but only painful when involved in the cutaneous cicatrix or deeper parts binding the soft parts to the bone.

FIG. 502.



Stump after
Pirogoff's ampu-
tation.

At times, however, stumps grow, and thus by increase of bone become conical. In the amputations of childhood this condition must be looked for; in the leg it is best seen, for it so happens that the shafts of bones grow most where they come in contact with the larger epiphyses, and in the leg the one entering into the knee-joint is a large one. In the case of a boy, æt 7, whose leg I had to amputate just below the knee, with some made-up skin flap, for a compound fracture, I have had to take away on two occasions, at intervals of three years, two pieces of bone at least an inch long, purely from the growth of the bone during childhood, and it was interesting to notice that the tibia on both occasions had grown twice as much at least as the fibula; indeed, in my second operation I never touched the fibula.

Painful stumps are most distressing; they are commonly caused by some increase in the bulbous condition of the divided nerve, the nerve being included in the cicatrix or pressed upon by the bone, and under such circumstances a cure is readily effected by the removal of the bulbous nerve. But in others the extreme pain seems to be due to hyperæsthesia, which is often called hysterical, the slightest touch of the end of the stump being sufficient to cause pain flying up the stump and convulsive twitchings of the limb. In these cases operative interference is useless. The general condition of the body which is usually associated with this affection requires attention; tonics are usually required, with local soothing anodyne applications, such as belladonna, opium, or stramonium ointments, &c.

Necrosis of the stump is a common condition; it is often due to too great a separation of the periosteum from the bone at the time of the operation from the forcible traction of the flaps backwards, and at times to a distinct endostitis of the divided bone (osteomyelitis). In the former case the necrosis is limited, and will probably show itself only as a ring of bone which may come away by itself or be removed. In the latter more or less of the shaft of the bone dies and subsequently exfoliates, the periosteum forming a new casing or sheath of bone to supply the dead bone's place, as in cases clearly described in the chapter on osteitis. The largest sequestrum I was ever called upon to remove from a stump was from the divided femur of a man whose leg I amputated for disease of the knee-joint consecutive to acute necrosis of the whole tibia. The femur became inflamed by endostitis after the amputation of the tibia, and ended in endosteal necrosis. The sequestrum was five inches long. I drew it out of the end of the stump some months after the amputation, and an excellent stump was left. At the present time I have a like case under care, necrosis of the stump following amputation for acute necrosis of the tibia extending into the knee-joint, in a child about six years old. The stump united after the operation by primary union, but the bone subsequently appeared in the wound as a necrosed mass, this change being attended with slight constitutional disturbance. In exceptional cases the soft parts slip away from the bone and retract as a whole, the bone suddenly perforating some inches

(Fig. 503); in such the periosteum is generally at fault, that covering the bone becoming inflamed and dying, the soft parts about it losing their attachment and retracting, and the bone deprived of its periosteum projecting from between the flaps as a dead or dying bone (periosteal necrosis). Under these circumstances the stump must be reopened and the end of the bone removed high up.

In India Dr. Fayrer, of Calcutta, tells us ("Clin. Surg.," 1866) that this osteo-myelitis of the ends of stumps is a common affection, and is often attended with severe constitutional symptoms, such as are well known to attend all cases of acute *endostitis* with or without amputation. He regards the affection as so serious that he advocates the reamputation of the limb above the next joint as soon as the earliest symptoms of systemic infection appear, blood poisoning being the chief danger of the disease. "The proper time," Fayrer writes, "for amputation in cases of diffused osteo-myelitis is as soon as possible after you have ascertained that the bone is affected; and the mode of arriving at this knowledge is simply the passage of a long probe down the medulla. Should it impinge on healthy and bleeding medulla near the surface, you may, if the constitutional symptoms permit, wait and see if nature is about to limit the suppuration and throw off the diseased bone, which is a rare result. Should it pass well up the bone, its whole death is certain. In cases of incipient inflammation the medulla will be found protruding like a fungus from the central cavity, and the bone surrounding it exposed to a greater or less extent; at a later period the end of the medulla is found already dead, blackened, and incrustated, but within it is a putrid mass of bone, debris, and pus. In the former stage you can watch the progress of the case. In the latter interference is immediately necessary, and that I fear can be nothing short of amputation, either above the next joint, or perhaps in a young subject at the epiphysis. The condition of the soft parts must not deceive; the condition of the bone and the constitutional symptoms must be the guide as to the time and necessity for operation."

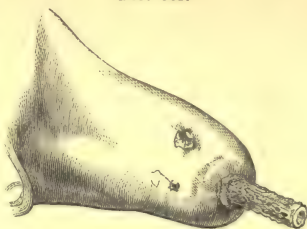
I have made this long extract from Fayrer's paper because it is through him that in recent times the subject has been brought prominently under notice. Longmore and Holmes, however, in this country have ably dwelt upon it, and Roux, of Toulon, made it the subject of a special report.

In acute cases there can be little doubt as to the wisdom of the practice suggested; they are not, however, in English practice of great frequency, the cases of necrosis of stumps being generally of a more chronic or sub-acute kind, and do not require such active treatment, whether of periosteal or endosteal origin.

Aneurismal enlargement of the arteries of a stump has been described by Erichsen on Cadge's authority; it is an accidental association.

Cancer may also attack a stump. In December, 1871, I removed the leg-stump of a man, æt. 58, for extensive cancerous disease of one year's standing, which attacked the cicatrix that had been formed fifty-four years (*vide* Fig. 205); amputation of both legs had been performed for gangrene of the bone when the patient had been a child four years old.

FIG. 503.



Necrosis of a stump.

CHAPTER XCII.

ELEPHANTIASIS—UMBILICAL TUMORS.

THIS term has been applied to two very different diseases, the *Elephantiasis Græcorum*, or true leprosy, and the *Elephantiasis Arabum*, or *Cochin* or *Barbadoes leg.* The former disease is probably a constitutional one; it appears as a tubercular affection of the skin, more especially of the face, attended with some loss of sensation. It is usually ushered in with slight febrile disturbance and local œdema. As the disease advances, the skin thickens and the tubercles multiply; the disease spreads, and involves the tongue, mouth, nose, eyes, and even larynx and lungs. In extreme cases ulceration exists, and disease of the bones, the subjects of the affection dying from exhaustion, if not of suffocation.

This disease is, happily, rare in this country, although it does occasionally occur; in Norway, in the Mediterranean, and in the Indies, it is, however, common. Dr. Webster, in the "Med.-Chir. Trans." for 1854, and Mr. Day, in the "Madras Quart. Journal" for 1860, give valuable information upon this subject, and Dr. Carter, in the "Trans. Med. and Phys. Society of Bombay," vol. viii, new series, enters fully into its pathology. A government report upon the affection may be looked for. To the surgeon the second form of elephantiasis, or the *Elephantiasis Arabum* is of the greatest interest. It is possibly a local affection, and is quite distinct from the true leprosy. It appears generally in one or other of the lower extremities; in the male or female genital organs it shows itself as a general infiltration into the skin and subcutaneous tissue of an organizable material, whereby the integument becomes hypertrophied and greatly thickened (page 590). In advanced disease the skin falls into great folds, and between these, fissures form, which subsequently pass into oozing ulcers. At times the foot and leg become the seat of extensive ulceration, which rarely cicatrizes.

The affection generally begins with some febrile attack, and the affected part becomes the seat of an erythematous redness and swelling, which subsides, again to recur, each attack leaving some extra thickening behind it. I have watched this in one case very clearly, and have no doubt that the erythema had some distinct relation to the disease.

Dr. Wise, of Calcutta, in 1835, looked upon the disease as one of the venous system, and as inflammatory. Dr. Carnochan, of New York, believes it to be associated with an enlargement of the arterial trunks of the part, and upon this based his practice of tying the main artery of the limb, and thus of starving the disease. Mr. Day, in the paper already alluded to, regards it as consecutive to malarious fever, and Mr. Dalton ("Lancet," 1846) looks upon it as a constitutional disease, like the leprosy.

From the ten or twelve cases I have seen I do not believe in the theory of its being due to disease of the venous system, for pathological evidence is wanting to support the view, but I am disposed to regard it as a true hypertrophy from excess of vascular supply. This view is supported by the clinical fact that in some cases, if not in all, where the main artery of the limb is ligatured, and the vascular supply to the disease cut off, a recovery takes place.

Carnochan, of New York, was the first surgeon to perform this operation (in January, 1851), and the success he met with, as published in a memoir on the subject in 1858, induced me to follow his example in 1865. The

case in all its details was published in the "Med.-Chir. Trans.," 1866, and the benefit of the operation was most striking. It was in a Welsh girl, æt. 25; the disease had been of two years' standing, and was spreading. The thigh of the affected limb (Fig. 504) measured twenty-seven inches round,

FIG. 504.

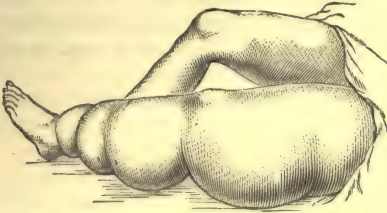
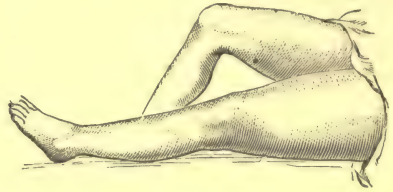


FIG. 505.



Case of elephantiasis Arabum before and after the application of a ligature to the femoral artery.

and the leg nearly twenty-three, the affected leg being nine inches in circumference larger than the sound one, and the thigh seven. Five weeks after the ligature of the external iliac artery the calf of the affected limb measured seven inches less than it did at the time of operation, and when she left the hospital the limb appeared as in Fig. 505. The rapid disappearance of the thickened tissue was very remarkable.

Since the operation the girl has gone on well; she is companion to a lady, and can walk many miles. The limb becomes slightly œdematous only on over-exertion.

I have performed the same operation since, but not with an equal success. I ligatured the femoral artery of a man who had the whole limb involved, the thigh being only slightly so, and for a time everything promised to be equal to the case recorded; but an attack of erythema appeared, which was followed by renewed swelling of the extremity, which never disappeared. In this case the size of the superficial femoral artery was extraordinary, the loop of the ligature when it came away being capable of admitting a No. 12 catheter. The vessel seemed to be nearly the diameter of my finger and was very thick.

The operation, however, appears to be worthy of repetition, and deserves more extensive trial. The vessel should be ligatured well above the disease, and the carbolized catgut ligature employed. I may add that Butcher in 1863, and Alcock in 1866, had successful cases; but Fayrer, of Calcutta, and Buchanan, of Glasgow, have not met with good results.

When surgical interference of this kind is not applicable, pressure should be tried, but what evidence exists is not much in its favor. All other treatment, medical or surgical, seems useless.

Tumors of the Umbilicus.—Pedunculated outgrowths from the umbilicus are not very uncommon, they are always found in children, and are composed of simple granulation tissue; indeed, it seems probable that they are really due to excess of granulation growth from the point at which the umbilical cord separated. They sometimes attain a large size. I have seen one the size of the last joint of my little finger. They are readily cured by the application of a ligature to their bases.

These outgrowths have at times a slight central canal or orifice, but the former never travels far.

These tumors must not be confounded with a condition that is occasionally met with—the presence of a fleshy outgrowth, not unlike a glans penis, through which a canal really passes into the bladder, the canal being clearly an open urachus. I have seen but one such case, and have recorded it in my Lettsomian lectures on the surgical diseases of children, 1863. I was

not permitted to do anything to it, although I wanted to cauterize the surface of the canal, and thus to cause its contraction and closure.

I have also seen a large hernial protrusion appear at the umbilicus, with the whole surface ulcerated; in it there were some solid contents, which I thought was the liver. It subsequently completely cicatrized, and a good recovery ensued. The drawing of this case is in the Guy's Hospital Museum.

Sebaceous tumors are seen also at the umbilicus, as well as accumulations of sebaceous matter in dirty people. I have turned out large masses of such indurated secretion from the cup-like depression.

Cancerous tumors, &c., may also exist there, as well as simple, warty growths, and syphilitic condylomata.

CHAPTER XCIII.

AFFECTIONS OF THE EXTERNAL EAR.

Malformations.—A well-formed external ear and lobule is not only a beauty, but it is commonly associated with intellectual cultivation and good breeding. An ill-formed external ear, a contracted *pinna*, or puny *lobulus*, is generally found in unrefined subjects, of feeble intellects, and to be seen in perfection must be sought for in lunatic and idiot asylums.

Malformations, however, in the usual acceptance of the term, occur under all circumstances, and are found to affect the auricle and meatus, together or separately. In 1865 I saw a boy, æt. 2, with total occlusion of the meatus; not even a fissure existed, and yet the external ear was perfect; the mother of the child, oddly enough, had an outgrowth from the front of the tragus of her corresponding ear. As a rule, however, when the meatus is occluded the external ear is deformed also. In 1867 I was consulted about a boy, æt. 7 weeks, who had complete occlusion of the meatus, and a deformed auricle. In this child a fibro-cartilaginous outgrowth, like the tragus of the ear, existed on the cheek, on a level with the lower jaw.

When the meatus is occluded or narrowed some malformation of the bones of the ear is generally present, and under such circumstances operative measures for relief are rarely successful. Should the meatus be closed only by a membrane a good result may be looked for.

Fleshy or fibro-cartilaginous outgrowths are not rarely met with about the ear, and more particularly about the tragus. Not long ago I removed three such from the front of the tragus of a child, ten weeks old, by means of the wire of the galvanic cautery. The ear otherwise was well-formed.

FIG. 506.



Drawing
224(21) 1/2.

Injuries of the External Ear.—This part of the body, like any other, may suffer from external injury; it may be contused from violence, and it is a question whether the blood tumor or *hæmatoma* of the insane is not the product of such a cause. At times blood may be extensively effused into the auricle. In 1868 a girl, æt. 18, came to me with the lobulus of one ear divided vertically downwards. She had, six months, previously, had an ear-ring torn out; by plastic operation the part was perfectly repaired. Extensive laceration of the external ear may be repaired; indeed, the pinna may be torn away from almost all its attachments, and reunite on a careful adjustment of the divided parts being made. Wounds of the

external ear generally do well; for the same reason *plastic operations* are, as a rule, successful. This fact was well illustrated in a case I treated in 1866, in a girl about 12, who some years before had suffered from some ulceration of the external ear, which left her in the condition indicated in the drawing (Fig. 506); by paring the edges of the pendulous portions of the auricle, and the skin covering in the parts behind, a good-looking entire ear was made, with great addition to her comfort.

Diseases of the External Ear.—The pinna, at times, enlarges without any clear cause—it becomes what is called *hypertrophied*; this enlargement is said to be due to the deposition of fat in the part, but more commonly it is the consequence of some chronic inflammation.

Chronic erysipelas is also met with, and is sometimes very obstinate. It must be treated on the same principles as erysipelas of other parts; the local application of glycerin and water, in equal proportions, relieves the local distress.

Chronic eczema of the ear is a painful and common affection; it often causes deafness by involving the auditory passage. It is to be treated like other eczemas, by alkalies, tonics, &c., the auditory canal being kept well cleared of all discharges and accumulation of cuticle by gentle syringing and the application of some mild unguent or glycerin fluid. At times the auditory canal becomes partially occluded by the thickening of the soft parts lining it, and at others by extension of the action to the membrana tympani itself.

Gouty concretions are at times met with in the auricle; they occasionally set up ulceration about them.

Tumors.—Many kinds of tumors are found on the external ear. One has been already described, the *cheloid or fibro-plastic tumor* that attacks the lobulus of the ear after the operation of puncture. I have seen many such; the largest was the size of a walnut (Fig. 507). They always do well after excision. I have never known their return, although such cases have been recorded.

Sebaceous tumors are by no means rare; they are found on all parts of the pinna. I removed one two and a half inches in diameter, of congenital origin, from a man, æt. 30; it had remained for twenty-seven years about the size of a nut, when it began to grow; I have excised also another the size of an orange from the lower part of the ear of a woman, æt. 53, of forty-one years' growth. At times these sebaceous tumors burst, and then fungate and put on many of the appearances of cancerous growths, but under the heading of follicular tumor, this question has received attention.

Fibrous tumors are also met with, and these appear to spring from the cartilage itself. I have seen but two examples; one was the size of a walnut, growing from the posterior part of the pinna of the ear of a man, æt. 53, of eighteen years' growth, and the second from the same part of the pinna of a boy, æt. 18, the size of a nut. I excised both tumors with a good result.

Cancerous tumors are found on the external ear, of the *epithelial* as of the *carcinomatous* kind. What is known as the *rodent ulcer* is also seen. In 1867 I saw a man, æt. 57, who had had a rodent ulcer of his ear and parts around for six years, and he told me his mother had lost her life from the same affection.

When these cancerous tumors exist they should be at once removed,

FIG 507.



Cheloid tumor of ear.

either by the cautery or excision. In 1864 I had to remove the whole ear of a gentleman, æt. 74, for a large epithelial cancerous growth of six years' standing. He lived six years after, and had no return of his disease. His hearing was, moreover, unaffected by the removal of the external ear.

Nævi are found here at times, and are to be treated as nævi of other parts.

Affections of the External Auditory Passage.—Wax in the Ear.—When the wax of the ear is allowed to accumulate in the auditory passage it may be regarded as a foreign body; such an accumulation produces, more or less, complete deafness. It is associated with a feeling of uneasiness in the part, and at times of pain, with noises in the head, giddiness, and loud crackling sounds on moving the lower jaw; should water trickle into the ear deafness will be increased. Nothing but syringing will remove the mass, and for the purpose a two or three-ounce syringe should be employed, with a smoothly working well-fitting piston, the stream of warm water or soap and water being thrown obliquely against the wall of the canal, in order that the water itself may get beyond the impacted mass, and thus force it out with the back flow. To send the stream against the mass of hard wax will not cause its removal, and to do so against the tympanum, healthy or diseased, may do harm.

When the wax is very hard a few drops of glycerin and water introduced twice a day for a few days will generally soften it sufficiently to allow of its removal by the syringe.

At times the *epidermis lining the meatus thickens and dries*, fills up the cavity, and causes deafness with some local uneasiness. The use of plenty of warm water and gentle syringing, and the mopping out of the canal after washing with a small piece of sponge dipped into a mixture of glycerin and water, seems to be the best practice; warm citrine ointment is recommended, but the glycerin seems equally useful.

Foreign Bodies in the Ear.—Children are very apt to introduce into the ear, as into any other opening, foreign bodies, such as peas, beans, beads, pebbles, &c., and when these have been pushed well into the auditory canal great difficulty may be experienced in their removal, for it should be remembered that the outer third of the auditory canal is the widest, the middle the narrowest, and the inner third wide again; the whole passage is incapable of expansion. When a body is pushed beyond the narrow portion it is difficult to get at.

When a foreign body has been introduced into the ear the sooner it is out the better, although at times such bodies have been known to have remained in for years without giving rise to much mischief, and at other times to come out by natural processes.

The surgeon should, consequently, always try and remove them, but before making an attempt he should satisfy himself that such a body really exists, and this is to be done by a careful examination of the part, aided by a speculum. The simple silver conical speculum is the best; all expanding instruments are bad.

At times the foreign body may be removed by means of syringing, the stream of water being injected as directed for the removal of accumulated wax against the upper wall of the auditory canal, so as to force the foreign body outward in its back flow. Should these means fail, I know of nothing equal to a loop of twisted silver or iron wire, the loop being passed well into the ear against one or other of its sides, and then turned half round, the foreign body being almost to a certainty noosed by it after one or two attempts, when it may be drawn out with a jerk. This method is

as useful for the removal of foreign bodies from the ear as from the nose, and cannot do harm.

The bent probes, forceps, &c., may be, as they have been, injurious, for all books on surgery contain records of cases in which frightful local injuries have been caused, and even life sacrificed, by vain attempts to remove foreign bodies by such means. At times, when one attempt has failed, a second may succeed a few days later.

Inflammation of the Auditory Canal and Otorrhœa.—The follicles naturally existing in the outer third of the canal may inflame and suppurate, and when they do they cause great pain; having discharged their contents, relief is usually felt, and convalescence follows. Warm fomentations and an early puncture, when pain is great, are to be recommended; at times some opiate is called for, on account of pain.

The lining membrane of the meatus or canal may likewise inflame in delicate children who are teething, or who have been the subjects of scarlet fever or other exanthem; at times from other causes, such as the accumulation of wax, or, indeed, without any clear cause; under these circumstances such an inflammation has been called catarrhal.

The affection shows itself by local swelling, redness, and the subsequent discharge of a more or less glutinous purulent discharge; at times with slight, at others with severe feverishness.

This affection is usually successfully treated by warm poppy or water fomentations and great local cleanliness, the gentle syringing of the ear with warm water not only giving comfort, but doing much good; the syringing must, however, be very gentle.

A mild purgative may be given when the bowels require it, and tonics are usually called for.

When the discharge from the ear is chronic, some astringent application may be required, such as the lead lotion or nitrate of silver solution, gr. v to the ounce of water.

The surgeon must remember, however, that *otorrhœa* is only a symptom. It may be the result of some such simple affection as has just been described, but it may be due to some more deeply situated disease, such as disease of the middle ear, or even of the petrous or mastoid portions of bone. Such serious conditions can generally be made out by the history of the case—the greater severity of the symptoms on their first approach, their chronicity, the fetor of the discharge, and the deafness with which it is associated.

These cases of disease of the bone of the ear are always serious; they may terminate favorably with or without necrosis; but when with necrosis only after exfoliation of bone. When they end badly, as they often do, they may destroy life by the extension of the inflammatory action from the bone of the ear to the dura mater and brain, and thus kill by arachnitis, or by some phlebitic abscess in the brain or cerebellum.

A large number of the cases of necrosis of the bones of the ear occur after scarlet fever or other exanthem, but many occur without in children, during the period of growth, when, it is well known, bone disease is very prone to appear.

At times large portions of bone exfoliate or may be taken away. In 1868 I removed from a boy aged one year and three-quarters, the mastoid process and all the ossicles of the left ear, the child having had a discharge from the ear for a year and a half; the disease did not follow any fever.

In 1866 I removed also, from a boy æt. 10, the necrosed mastoid process, the result of disease after scarlet fever six years before. I give these two cases as types of the classes out of many I could give.

In all cases of otorrhœa great cleanliness should be observed.

When necrosis exists the bone should be removed by operation as soon as possible, and all head symptoms should be regarded in a serious aspect. At times, when evidence exists of disease about the mastoid process, and headache of a persistent character shows itself, a free incision over the affected bone not only gives relief, but seems to be of great value. When arachnitis or other symptoms of encephalitis appear all surgical treatment is useless—deepseated abscess of the brain or cerebellum being too often the cause of death.

Polypus.—Hinton tells us that the most frequent seat of polypi is the exposed tympanic wall; next, the inner part of the meatus; the least frequent being the external surface of the membrane; that those that spring from the walls of the tympanum and meatus possess a glandular structure which is wanting in those which spring from the outer surface of the membrana tympani. He adds, whatever their seat and nature, they require essentially the same treatment, viz., the soothing of any irritation by blisters and lead lotions, the removal of all accumulated discharge by the syringe, the eradication of the growth by Wilde's snare or nasal polypus snare, and restoration to a healthy state of the surface from which it sprang, by the daily local application of caustics, such as the nitrate of silver, and thorough cleanliness.

Granulations springing from the tympanum, which appear often as polypi, should be treated as the root of a polypus, by caustics. They indicate, almost always, disease of the tympanum.

Sebaceous tumors are met with in the meatus, and if neglected they may cause absorption of bone, and even brain disease. They should be treated by removal.

Exostoses are likewise occasionally seen.

CHAPTER XCIV.

ON PARASITES.

Guinea-worm.—The *Dracunculus* or *Filaria medinensis* is one of the most troublesome parasites known in Africa, Asia, India, and tropical America. In Europe it is only occasionally met with in those who have visited the above districts.

The mature worm varies in length from two to six feet. It is cylindrical in form and white in color; it has a smooth surface, and is tough and elastic; its mouth appears as a circular orifice; it has no anus. How the worm enters the body is unknown; and when it has entered, symptoms of its presence appear only when the time has arrived for the discharge of the mature embryos with which it is filled. How long it may remain quiescent is uncertain; Busk tells us that the period is usually about twelve months, but it may be eighteen ("Holmes's Syst.," vol. v). During this time the worm rests in the cellular tissue. When mature it makes its presence known by some swelling, circumscribed as a rule, diffused as an exception; itching, pain, and redness, as of an inflamed boil; considerable constitu-

tional disturbance often attends these local changes. When left to itself the worm invariably presents itself head first, and this may generally be seen before the pustule or boil has been opened. When the worm has been detected its extraction should be conducted with care; the protruding portion should be wound round a piece of stick or bougie day by day. Should too much force be employed the worm will break, and by its natural elasticity be withdrawn into the tissues, where it will die and give rise to extensive sloughing of the cellular tissue in its track. In some cases the original orifice may heal, and a fresh opening appear. A careful incision across its track, at times, may find it, when it should be carefully raised, and wound out as directed.

Chigoe, Chigger, or Gigger, or Sand-flea.—This is found in the West Indies and in South America, but the impregnated female only infects man. It makes its way beneath the nails or between the toes by means of its long proboscis, and, having gained an entrance, rapidly increases to a white globular vesicle the size of a pea. Some local irritation attends its presence. To prevent trouble, the insect should be carefully turned out of its bed by dilating the orifice through which it entered with a needle, care being observed not to rupture the globular vesicle which contains the ova, for these escape into the cellular tissue, and are often followed by tedious suppuration and ulceration.

The echinococcus or hydatid, the larva of the *tænia échinococcus*, is a common entozoon in the human subject; it may exist as a microscopical object, or as a cyst of many inches in diameter. It has highly elastic laminated walls, lined with a granular layer; it is usually inclosed in the parts of the body infected by it in a distinct capsule, formed by exudation into and the consolidation of the surrounding tissue. It contains a clear, watery, non-albuminous fluid, in which at times float some *tænia* heads or scolices, the so-called echinococci, or in which are found the hooklets which surround the head.

These hydatids are met with in any part of the cellular tissue of the body—in the lungs, liver, abdominal cavity, pelvis, and even in the bones—a specimen existing at Guy's in which the spinal column was so affected. I have seen them turned out of the breast, tongue, thyroid gland, pelvis, vagina, uterus, and bladder. I have removed a cyst containing them from the muscles of the neck, axilla, and thigh; and have treated many also in the liver.

At times an acephalocyst contains many secondary cysts; I removed a basinful from one occupying the pelvis ("Path. Soc. Trans.," vol. xvii); they were of all sizes. Hydatid tumors are to be recognized by negative symptoms; they appear as tense, globular, elastic swellings in a part, and give rise only to such symptoms as are to be explained mechanically by their presence.

TREATMENT.—This must vary with the position, size, and growth of the hydatid tumors. When the parasite occupies some position in the body outside one of its great cavities, and it can be turned out of its bed by means of a free cut into its capsule, no better treatment is wanted. When it occupies one of the abdominal viscera, or one of the serous cavities, it should be left alone, unless from its size it interferes with important functions or threatens life, but this point has been already discussed in pages 299 and 301.

The cysticercus cellulosæ, the cystic scolex of the common tapeworm, is found in man, and is said to be the common parasite of the "measly pig." It has a quadrangular head, short neck, and cylindrical vesicular body;

its head is surrounded with characteristic hooklets. It is found more particularly in the muscles and intermuscular tissue; it may affect the viscera as the former hydatid, and is known in the eye, brain, heart, &c. It is to be treated, when interference is called for, by an incision into the part and its removal.

Trichiniasis has been considered in the chapter devoted to the affections of the muscles, page 905.

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